# 7 — RF Troubleshooting and Manual Tuning Guide


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## Introduction to RF troubleshooting

All measurements should be done using:

- spectrum analyser with a high-frequency high-impedance passive probe (LO-/reference frequencies and RF power levels)
- oscilloscope with a 10:1 probe (DC-voltages and low frequency signals)

> **Caution:** A mobile phone WCDMA transmitter should never be tested with full Tx power, if there is no possibility to perform the measurements in a good performance RF-shielded room. Even low power WCDMA transmitters may disturb nearby WCDMA networks and cause problems to 3G cellular phone communication in wide area. WCDMA Tx measurements should be performed at least in an RF-shielded box and never with higher Tx power level than 0 dBm! Test full WCDMA Tx power only in RF-shielded environment.

The RF section of the phone is build around two RF ASICS: Rx ASIC N7500 and Tx ASIC N7501. There are also two PA's on board, one for GSM (N7502) and another for WCDMA (N7503).

The WCDMA PA needs variable supply voltage to work properly and therefore there is a switched mode power supply component (N7504) added to the PWB.

Please note that the grounding of the PA module is directly below the PA module. Therefore, it is difficult to check or change the module.

Most RF semiconductors are static discharge sensitive! ESD protection must be taken care of during repair (ground straps and ESD soldering irons). N7501, N7500, both PAs and SMPS are moisture sensitive, so parts must be pre-baked prior to soldering.

In addition to key components, there are lot of discrete components (resistors, inductors and capacitors) which troubleshooting is done mainly by checking if the soldering of the component is done properly.

Capacitor can be checked for shorts and resistors for value by means of an ohmmeter, but be aware in-circuit measurements should be evaluated carefully.

Keep in mind that all measured voltages or RF levels depicted in the service manual are rough figures. Especially RF levels vary because of different measuring equipment or different grounding of the probe used.

When using an RF probe, use a pair of metallic tweezers to connect the probe ground to the PWB ground as close to the measurement point as possible. If measurements are performed in a product specific module jig then "GND" pads should be used for the probe ground.

For additional RF troubleshooting instructions, see Appendix A. These instructions include descriptions/ instructions for RF self-tests as well as troubleshooting instructions for various fault cases.

## RM-1 RF key component placement

The RF section of the phone is build around two RF ASICs, Rx ASIC N7500 and Tx ASIC N7501.

There are also two PAs on the board, one for GSM (N7502) and one for WCDMA (N7503). The WCDMA PA needs variable supply voltage to work power efficiently and therefore there is a Switched Mode Power Supply (SMPS) component (N7504) added to the PWB.


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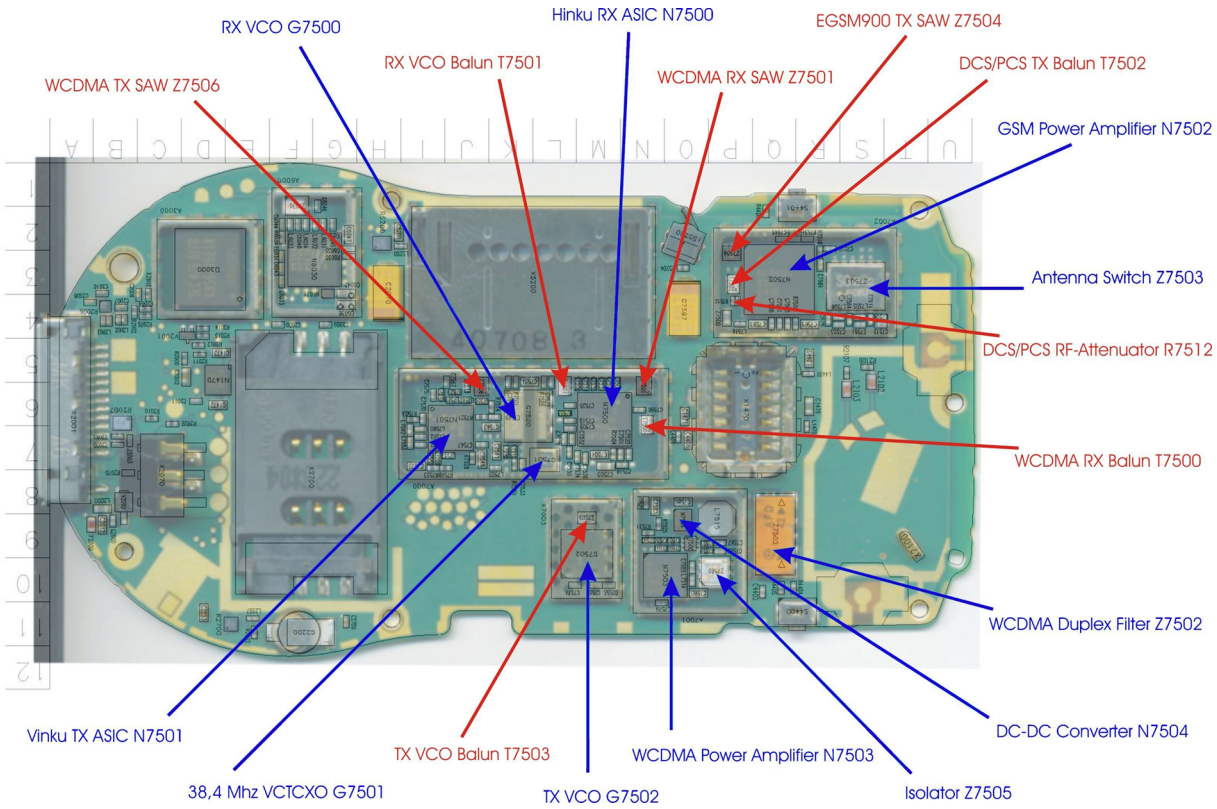


Figure 63 RF key component placement


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## RM-1 fault finding test point locations

### Test points for spectrum analyzer

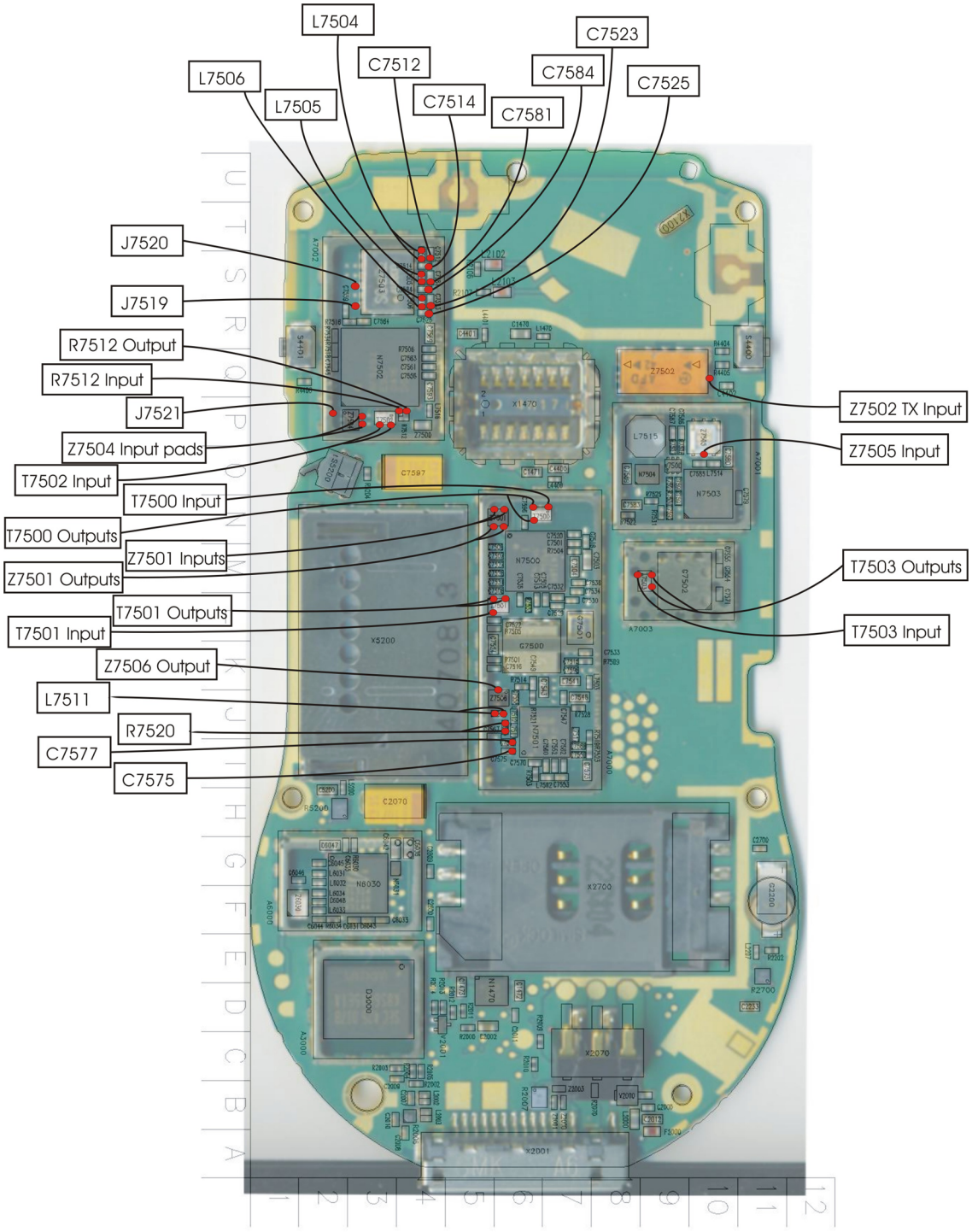


Figure 64 Test point locations for spectrum analyzer


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## Test points for oscilloscope

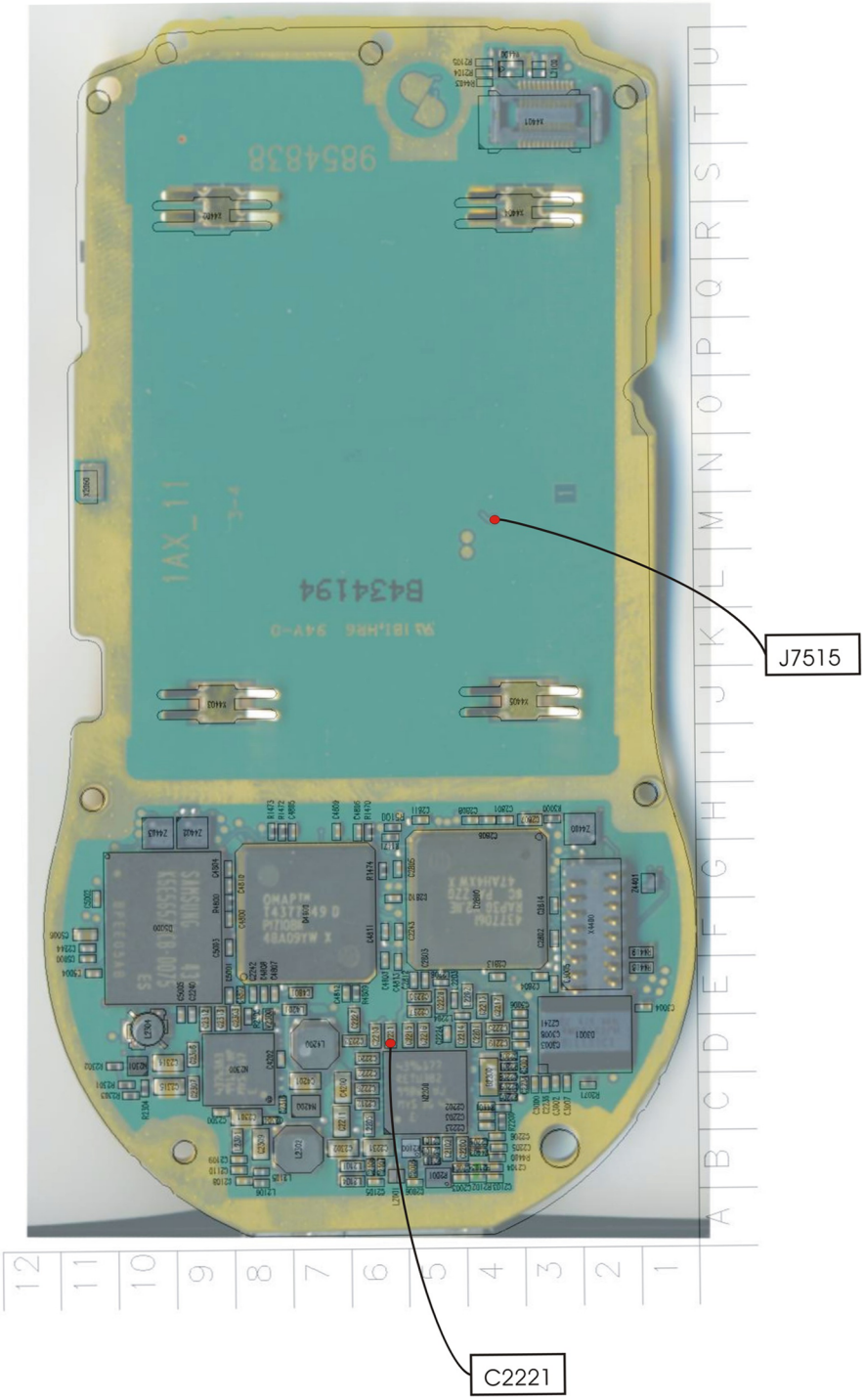


Figure 65 Test points for oscilloscope - bottom


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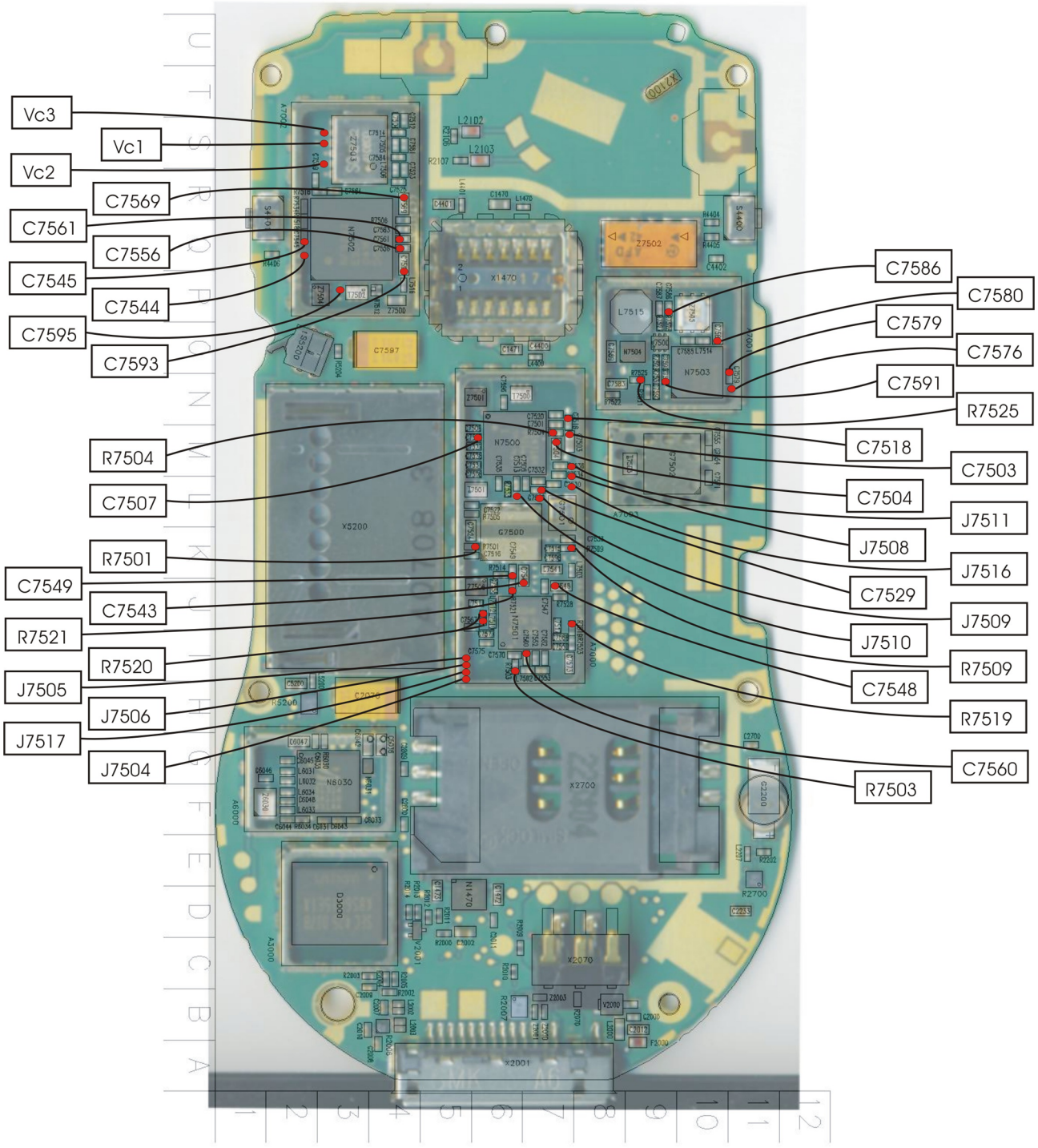


Figure 66 Test points for oscilloscope - top

## Receiver troubleshooting

### Introduction to Rx troubleshooting

Rx can be tested by making a phone call or in the local mode. For the local mode testing, use Phoenix service software.


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The main Rx troubleshooting measurement is RSSI measurement. This test measures the signal strength of the received signal. I and Q branches can be measured separately. For GSM RSSI measurement, see GSM Rx chain activation for manual measurements / GSM RSSI measurement (Page 7–10), and for the same measurement in WCDMA, see WCDMA RSSI measurement (Page 7–12).

In GSM, the input signal can be either a real GSM signal or a CW signal that is 67.771kHz up from the carrier frequency.

For service tool usage instructions, refer to section Service Tools and Service Concepts.

### See Also

- WCDMA Rx chain activation for manual measurement (Page 7–11)

## GSM Rx chain activation for manual measurements / GSM RSSI measurement

### Context

RSSI signal measurement is the main Rx troubleshooting measurement. The test measures the strength of the received signal.

I and Q branches can be measured separately. In GSM, the input signal can be either real GSM signal or CW signal that is 67.771kHz up from the carrier frequency.

### Steps

1. Start *Phoenix* service software.
2. From the Testing menu, choose GSM and RSSI Reading.
3. Setup RF signal generator for channel frequency +67.771kHz CW mode with –80dBm signal.
   Alternatively set cellular tester downlink channel to an appropriate channel.
4. In the RSSI Reading window, select the appropriate band and channel.

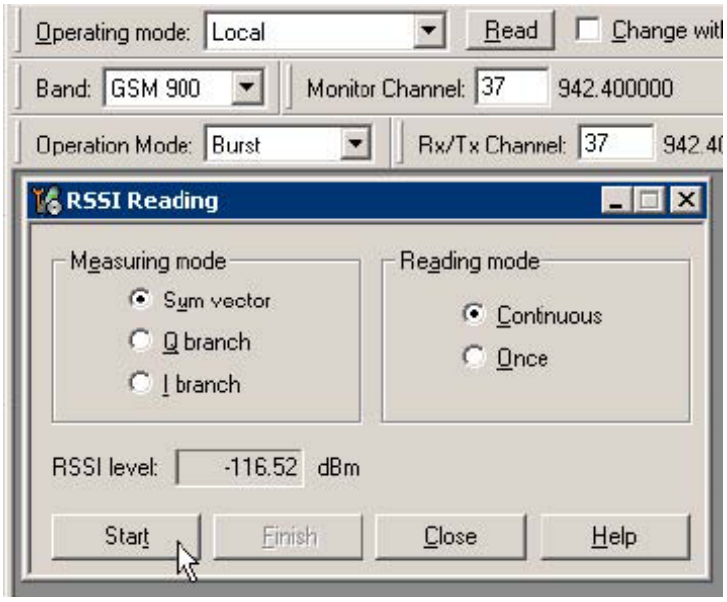


Figure 67 RSSI Reading window

5. To start measurement/activate GSM Rx chain, click the Start button.

### Results

RSSI reading values of the selected band and channel are displayed.


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## WCDMA Rx chain activation for manual measurement

### Steps

1. Start *Phoenix* service software.
2. From the Testing menu, choose WCDMA and Rx Control.

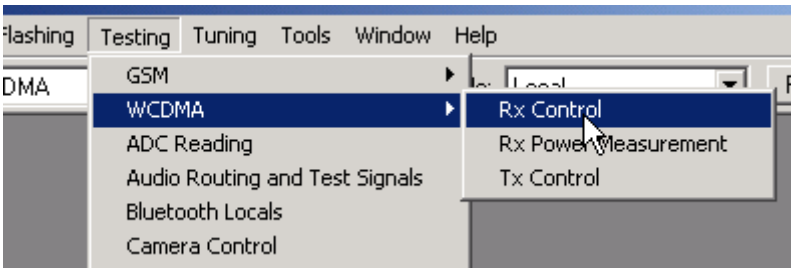


Figure 68 Activating Rx Control window in Phoenix

3. In the Rx Control window:

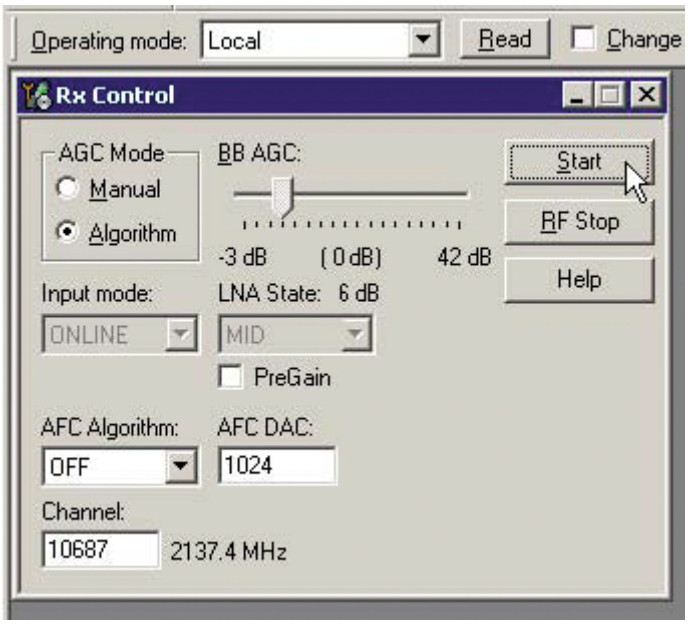


Figure 69 Rx Control window

- From the AGC Mode pane, select Algorithm.
- Set AFC Algorithm to OFF (Default = OFF).
- Set Channel to 10700.

### Next action

When settings are ready, click Update to activate them.

If settings are changed later on (for example, you give a new channel number), you will need to click RF Stop and Update again.

**Note:** Clicking RF Stop also disables Tx Control if that was active!


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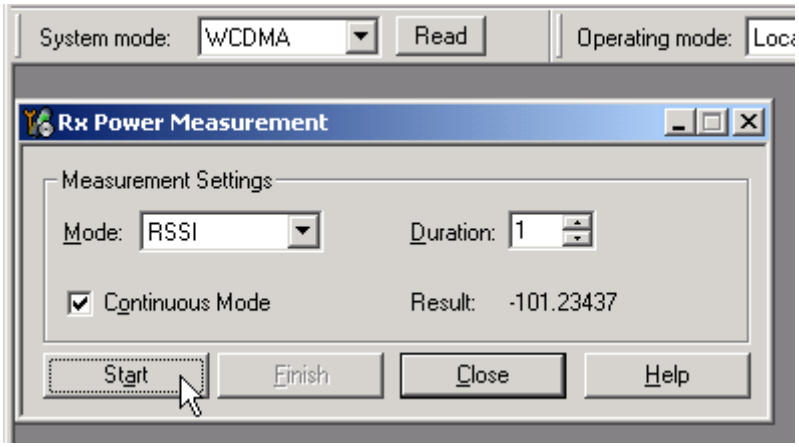
## WCDMA RSSI measurement

### Before you begin

WCDMA Rx must be activated before RSSI can be measured. See WCDMA Rx chain activation for manual measurement (Page 7–11).

### Steps

1. From the Testing menu in Phoenix, choose WCDMA -> Rx Power Measurement.
2. In the Rx Power Measurement window, choose the following settings:
   - Mode: RSSI
   - Continuous Mode




3. To perform the measurement, click Start.

# Transmitter troubleshooting

## General instructions for Tx troubleshooting

### Context

- Tx troubleshooting requires Tx operation.
- Do not transmit on frequencies that are in use!
- Transmitter can be controlled in the local mode for diagnostic purposes.
- The most useful Phoenix tool for GSM transmitter testing is "RF Controls" and in WCDMA transmitter testing the best tool is "Tx Control"..
- Tx IQ tuning and Tx power tuning can be also used in some cases.
- Remember that retuning is not a fix! Phones are tuned correctly in production.

The first set of steps instructs how to assemble the test setup. This setup is general for all Tx troubleshooting tasks.

Alternative steps provide specific troubleshooting instructions for *Phoenix* service software. The first section is for the EGSM900/GSM1800/GSM1900 bands and the latter for WCDMA.

> **Caution:** Never activate the GSM or WCDMA transmitter without a proper antenna load. There should be always 50 ohm load connected to the RF connector (antenna, RF-measurement equipment or at least 2 watts dummy load), otherwise GSM or WCDMA PA may be damaged.

### Steps

1. Connect a test jig to a computer with a DAU-9S cable or to a FPS-8 flash prommer with a modular cable.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Make sure that you have a PKD-1 dongle connected to the computer's parallel port.

2. Connect a DC power supply to a module jig (MJ-26).

   **Note:** When repairing or tuning a transmitter, use an external DC supply with at least 3 A current capability.

   Set the DC supply voltage to 3.9 V and set the jumper connector on the test jig's **reg.pass** switch to "ON" position.

3. Connect an RF cable between the RF connector of the module test jig (MJ-26) and measurement equipment or alternatively use a 50 ohms (at least 2 W) dummy load in the module test jig RF connector, otherwise GSM or WCDMA PA may be damaged.

   **Note:** There are three antenna connectors in the module jig:

   - one for GSM
   - one for WCDMA
   - one for Bluetooth

   Make sure that all connections are made to the correct RF connector.

   Normally a spectrum analyser is used as measurement equipment.

   **Note:** The maximum input power of a spectrum analyser is +30 dBm.

   To prevent any damage, it is recommended to use 10 dB attenuator on the spectrum analyzer input.

4. Set Tx on.

   i Set the phone module to the test jig and start *Phoenix service software*.

   ii Initialize connection to the phone. (With FPS-8 use FBUS driver when using DAU-9S and COMBOX driver).

   iii From the File menu, choose product: *File -> Choose Product -> xx-x**(* = type designator of the phone).

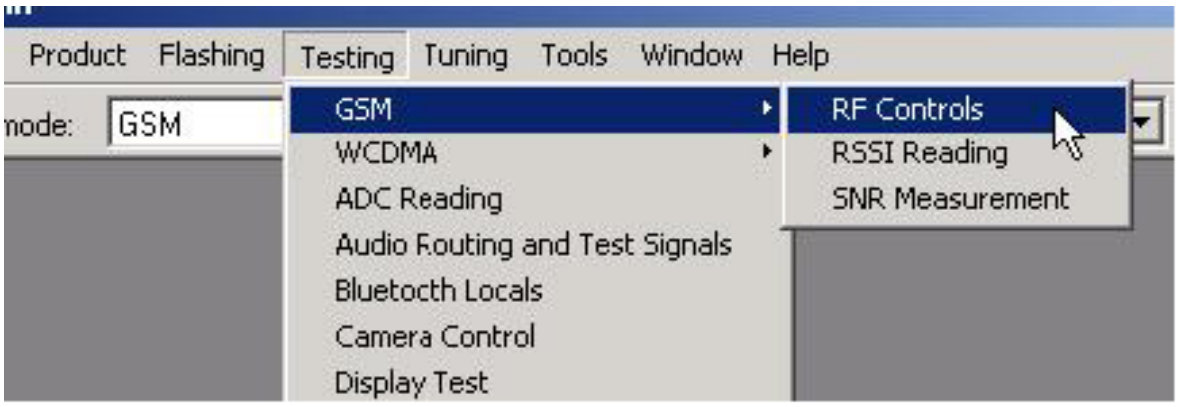
   iv From the toolbar, set operating mode to "Local".

## Alternative steps

- EGSM900/DCS1800/PCS1900 troubleshooting

  i From the toolbar, set system to "GSM".

  ii From the Testing menu, activate the *RF Controls* window: *Maintenance -> Testing -> GSM -> RF Controls*.




  iii In the *RF Controls* window:

  - Select band "GSM900" or "GSM1800" or "GSM1900" (Default = "GSM900").
  - Set Active unit to "Tx" (Default = "Rx").
  - Set Operation mode to "Burst" (Default = "Burst").
  - Set Tx data type to "All1" (Default = "All1").
  - Set Rx/Tx channel to 37 on GSM900 band or 700 on GSM1800 band or 661 on GSM1900 (Defaults).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- Set Edge to “Off” (Default).
- Set Tx PA mode to “Free” (Default).
- Set power level to 5 (Default = 19) on GSM900 or to 0 (Default = 15) on GSM1800 or GSM1900.

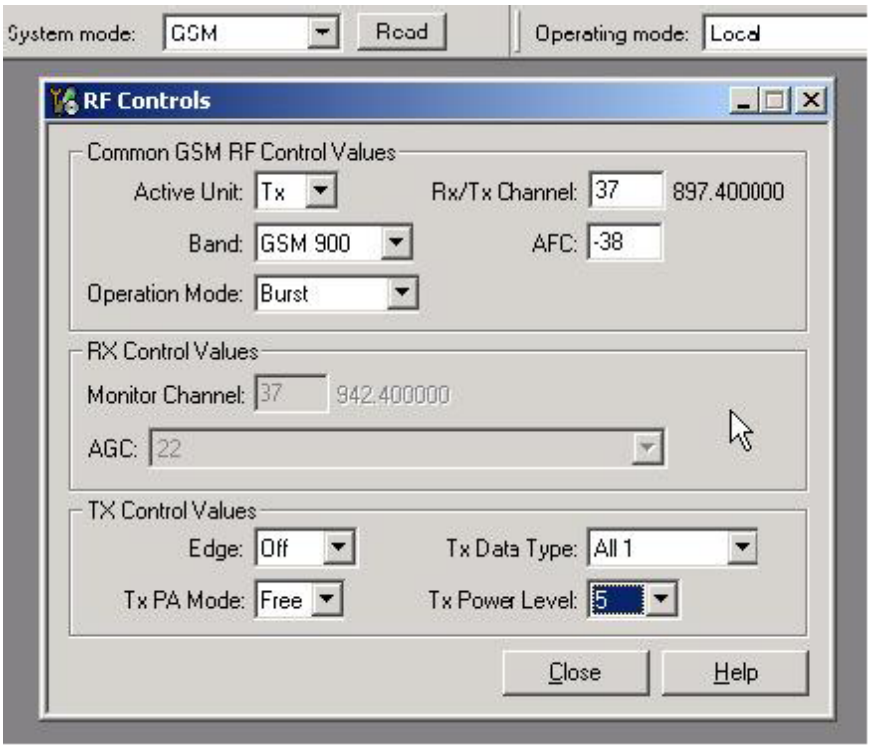
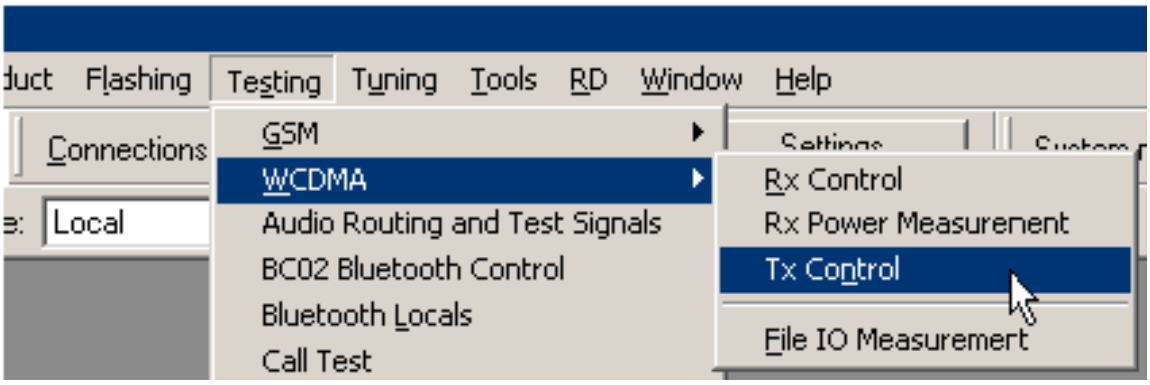



Figure 70 RF Controls window

- WCDMA troubleshooting
  - i From the toolbar, set system to "WCDMA".
  - ii From the Testing menu, activate the *Tx Control* window: *Maintenance -> Testing -> WCDMA -> Tx Control*.




  - iii In the *Tx Control* window:
    - Select the *Algorithm mode* tab.
    - Set Start level to “0” dBm (Default = “0”).
    - Set Step size, Step count and Sequence to “0” (Default = “0”).
    - Set Scrambling code class to “LONG” (Default = “LONG”).
    - Set Scrambling code to “16” (Default = “16”).
    - Set DPDCH Code number to “0”, Code class to “2” and Weight to “15” (Defaults).
    - Set DPCCH Code number to “0”, Code class to "2" and Weight to “8” (Defaults).
    - Set DPDCH enabled (Default).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- Set Channel to 9750.

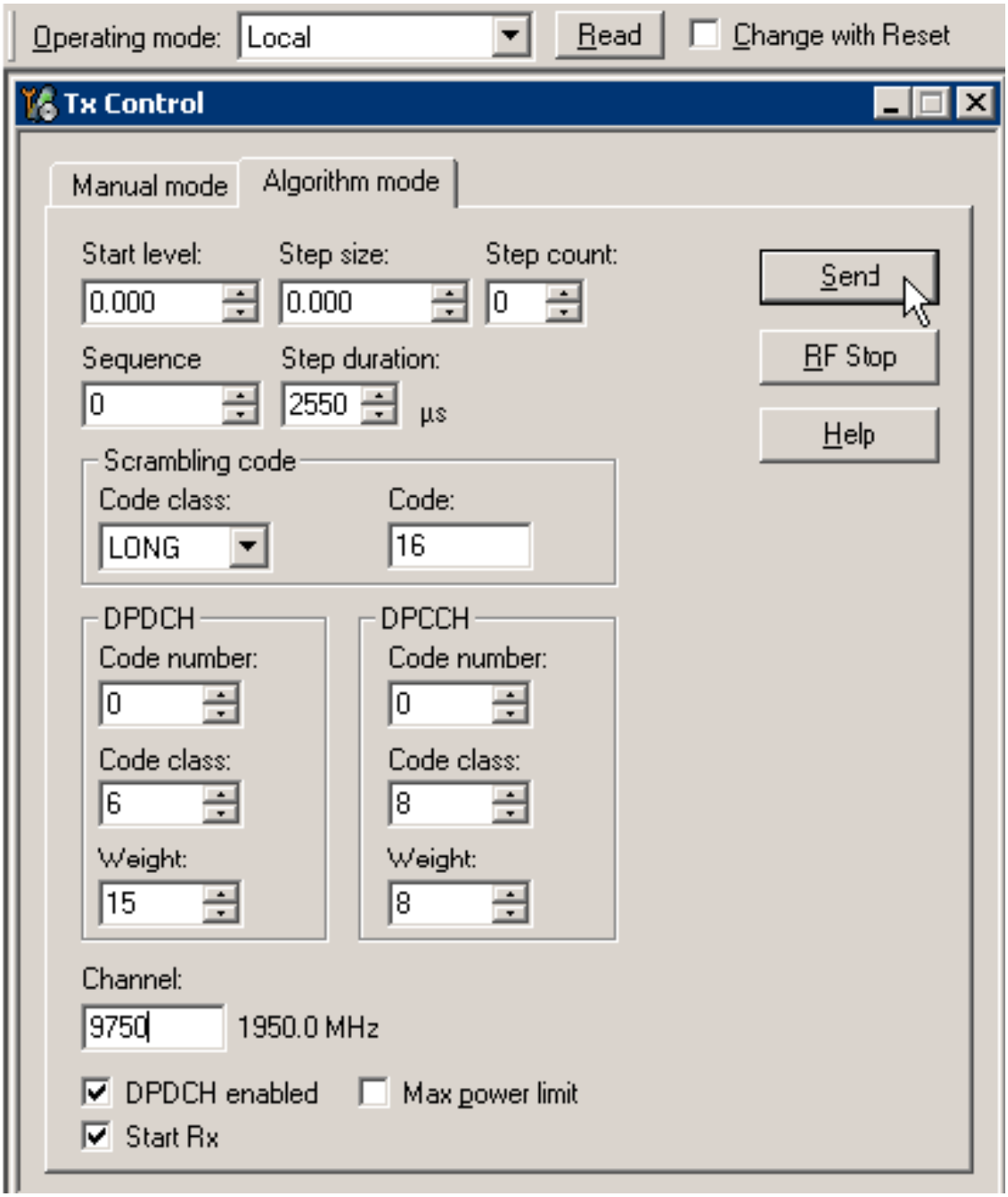


Figure 71 Tx Control window

### Next action

When settings are done, click “Send” to enable them.

If you change the settings (e.g. give a new channel number), you need to click “Stop” and “Send” again.

## Checking antennae functionality

The main antenna has two separate antenna elements: GSM and WCDMA.

In the GSM antenna, there is one Feed and two GND contacts.

In the WCDMA antenna, there is one Feed and one GND contact.


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The contacts of the GSM antenna are separated in the (RDC = 0 ohm) short-circuit. The contacts of the WCDMA antenna are in the (RDC = 0 ohm) short-circuit.

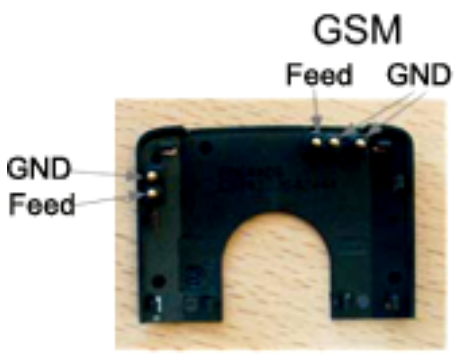



Figure 72 Main antenna, GSM and WCDMA

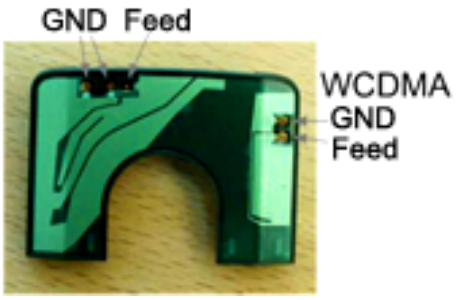
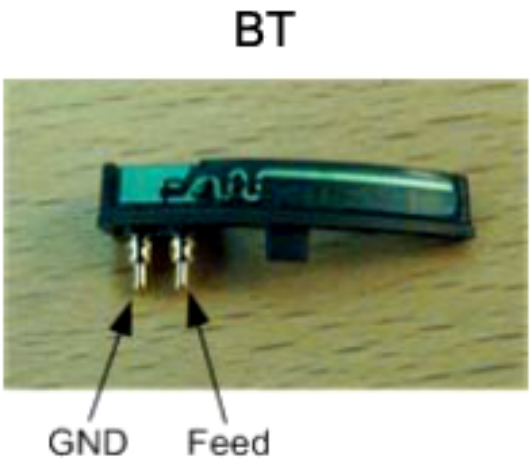


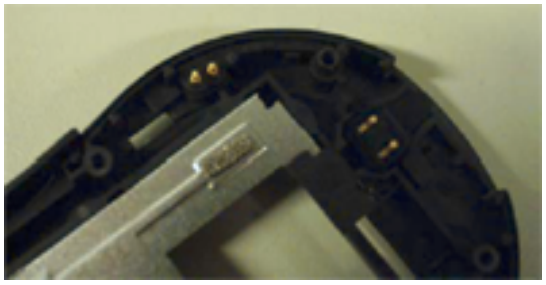

Figure 73 Feed and GND spots of the main antenna

The antenna is functioning normally when the contacts function (RDC = 0 ohm) and the antenna is visually intact.

## BT antenna

BT antenna has one Feed and two GND contacts. The antenna is functioning normally when the contacts function (RDC = 0 ohm) and the antenna is visually intact.

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# RF manual tuning guide

## Introduction to RF tunings

Phone RF is tuned in production. There is no reason to do the re-calibration unless:

- One or more of the RF components is changed
- FLASH Memory chip (D3000) is changed or otherwise corrupted.

RF calibration is always performed with the help of module jig MJ-26. Whenever possible, automatic tuning system should be used.

If manual tuning is used, only relevant tunings should be performed. Refer to the table below:

| Changed component | Perform following tunings |
|---|---|
| Tx RF ASIC Vinku (N7501) | RF Channel Filter Calibration, Tx IQ Tuning, Tx Power Level Tuning, Temperature Sensor Calibration, TX AGC & Power Detector, Tx Band Response Calibration, Tx LO Leakage |
| RX RF ASIC Hinku (N7500) | RF Channel Filter Calibration, Rx Calibration, Rx Band Filter Response Compensation, Rx AM Suppression, Rx AGC Alignment, Rx Band Response Calibration |
| Any component in the GSM TX RF chain before the PA | Tx IQ Tuning, Tx Power Level Tuning |
| Any component in the GSM TX RF chain after the PA or PA | Tx Power Level Tuning |
| Any component in the WCDMA TX RF chain before the PA | Tx AGC & Power Detector, Tx Band Response Calibration, Tx LO Leakage |
| Any component in the WCDMA TX RX chain after the PA, PA, power detector or PA switch mode power supply | Tx AGC & Power Detector, Tx Band Response Calibration, PA Detection |
| Any component in the GSM RX chain | Rx Calibration, RX Band Filter Response Compensation, RX AM Suppression |
| Any component in the WCDMA RX chain | Rx AGC Alignment, RX Band Response Calibration |

### Cable and adapter losses

RF cables and adapters have some losses. They have to be taken in account when the phone is tuned. As all the RF losses are frequency dependent, the user have to be very careful and understand the measurement setup. In the following table there are RF attenuations of the module jig, MJ-26:

| Band | Attenuation |
|---|---|
| GSM900 | 0.2 dB |
| GSM1800 | 0.3 dB |
| GSM1900 | 0.3 dB |
| WCDMA 2100<br>(WCDMA connector) | 0.5 dB |


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## RF autotuning with CMU200

### Before you begin

Recommended test set-up:

- Windows 2000 PC
- CMU200 communication tester
- USB to GPIB converter from National Instruments. Order information: 778416-01 GPIB-USB-B, NI-488.2 for Windows 2000/XP/Me/98.

Before you can use the auto-tune feature, the GPIB driver from the GPIB card vendor must be installed and running.

Then the auto tune **.ini** file must be in a correct place: **C:\Program Files\Nokia\Phoenix\products\xx-x*\autotune_xx-x*.ini** (*= indicates the type designator of the phone, e.g. RM-1)

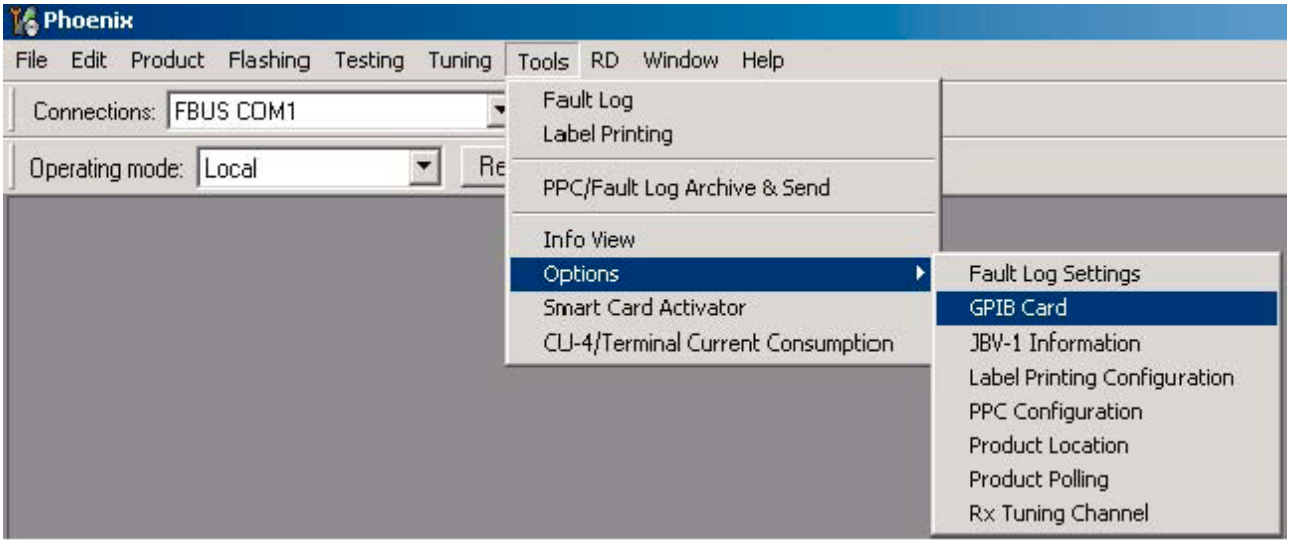
### Context

It is possible to perform an automatic RF tuning with the aid of CMU200. Autotuning covers all RF tunings that are needed to perform after RF component repairs.

> **Note:** Do not perform RF autotuning “just for sure”. Phones are tuned in the production and RF tuning may performed only after component repairs or if the RF tuning information is lost.

### Steps

1. Connect CMU200 to the GPIB bus.
2. From the Tools menu in Phoenix, choose Options -> GPIB Card.




3. In the Card Type line, select CEC8Bit, then click Start.

   After clicking Start, the name of the CMU200 communication tester appears in the list of found Listeners.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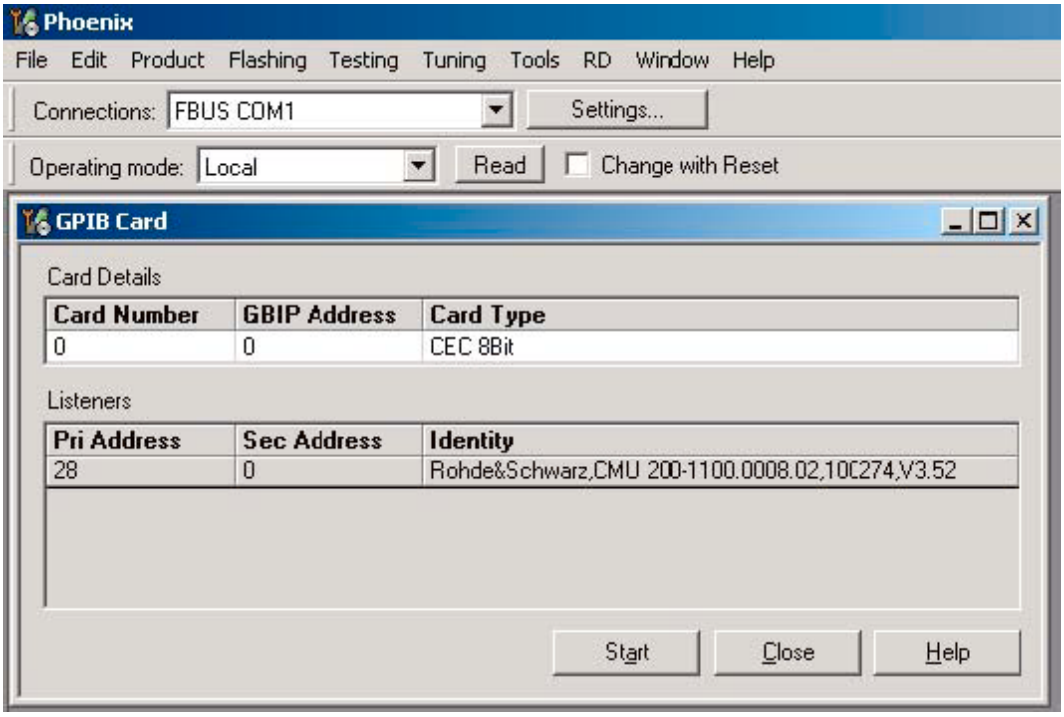
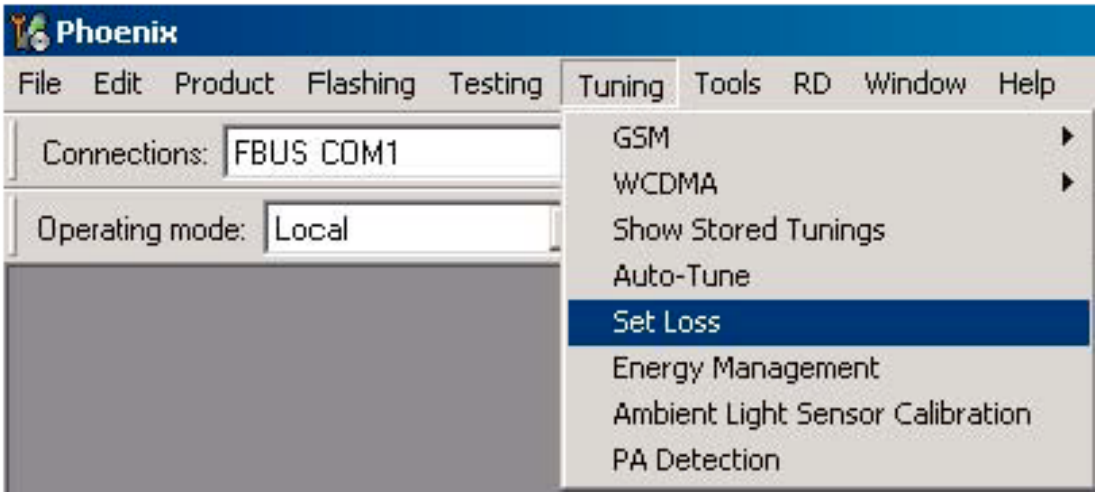



4. To specify the cable loss from module jig to CMU200, choose Set Loss from the Tuning menu..




5. In the Set Loss window, click the Jig tab and select the right jig for the phone.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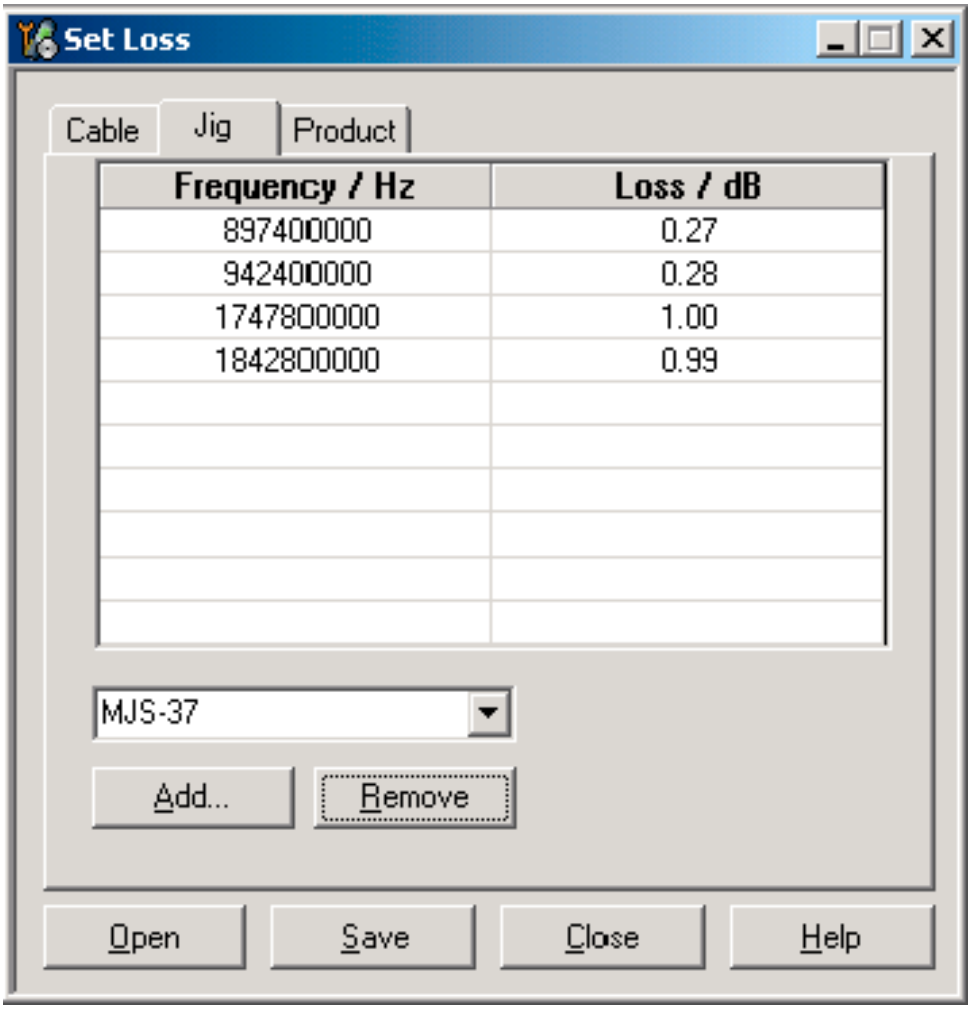


6. Click the Cable tab and add the extra cable attenuation.


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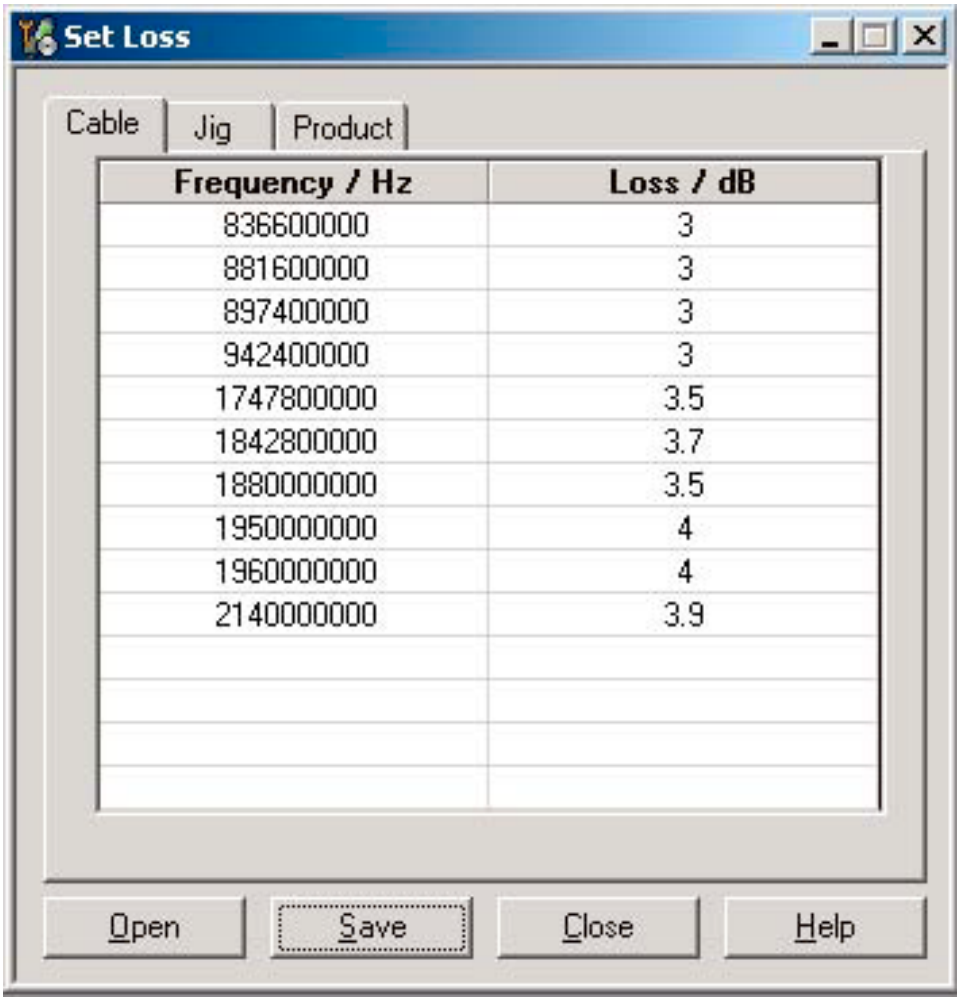
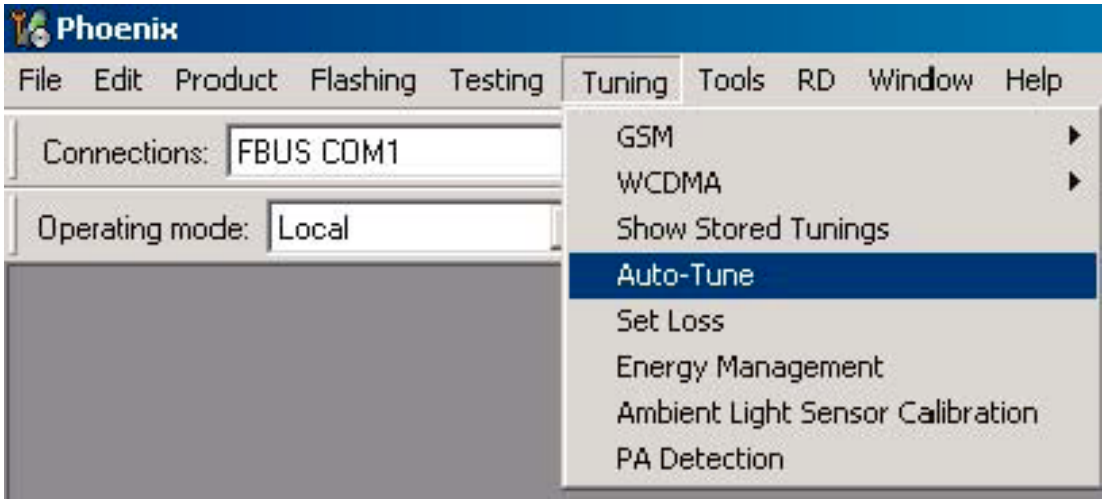



7. To start autotuning, choose Auto-Tune from the Tuning menu.




8. In the Auto-Tune window, click Options.
9. In the Auto-Tune options window, see that the "Enable showing of messages" check box is checked. Then click OK.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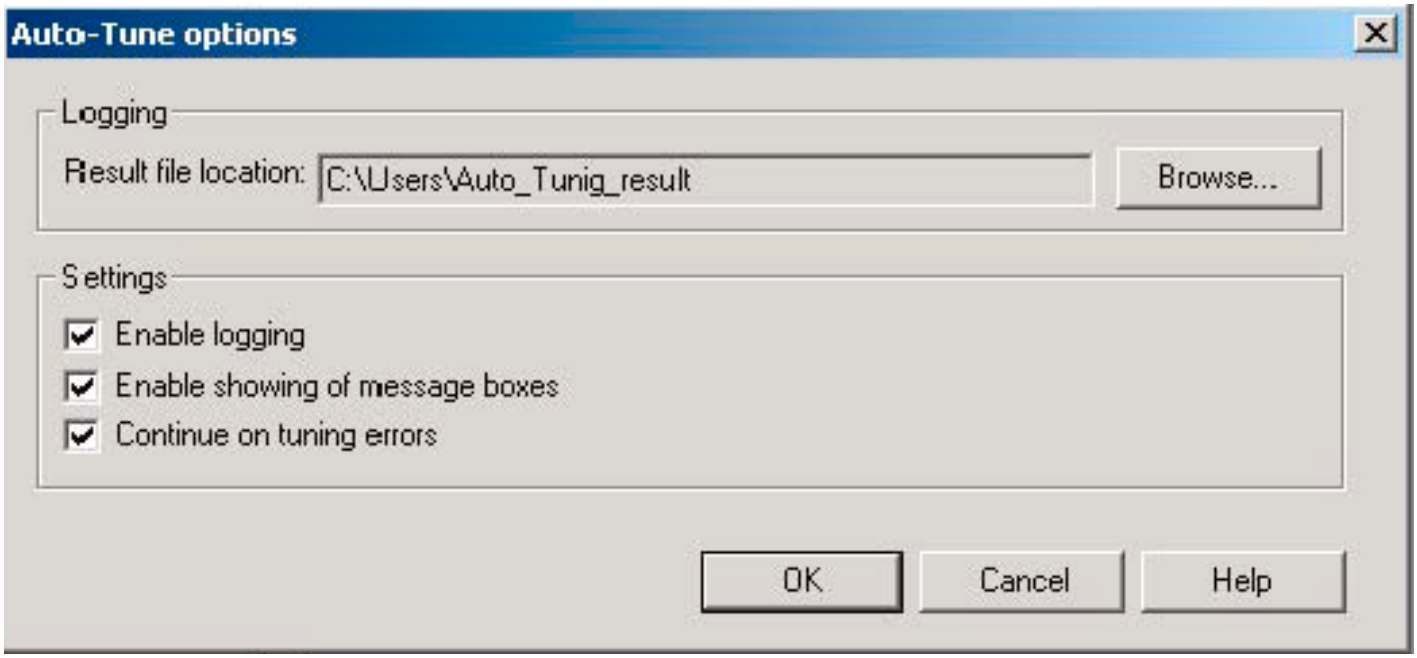


10. Connect the phone's WCDMA RF port to CMU200 and click Tune.


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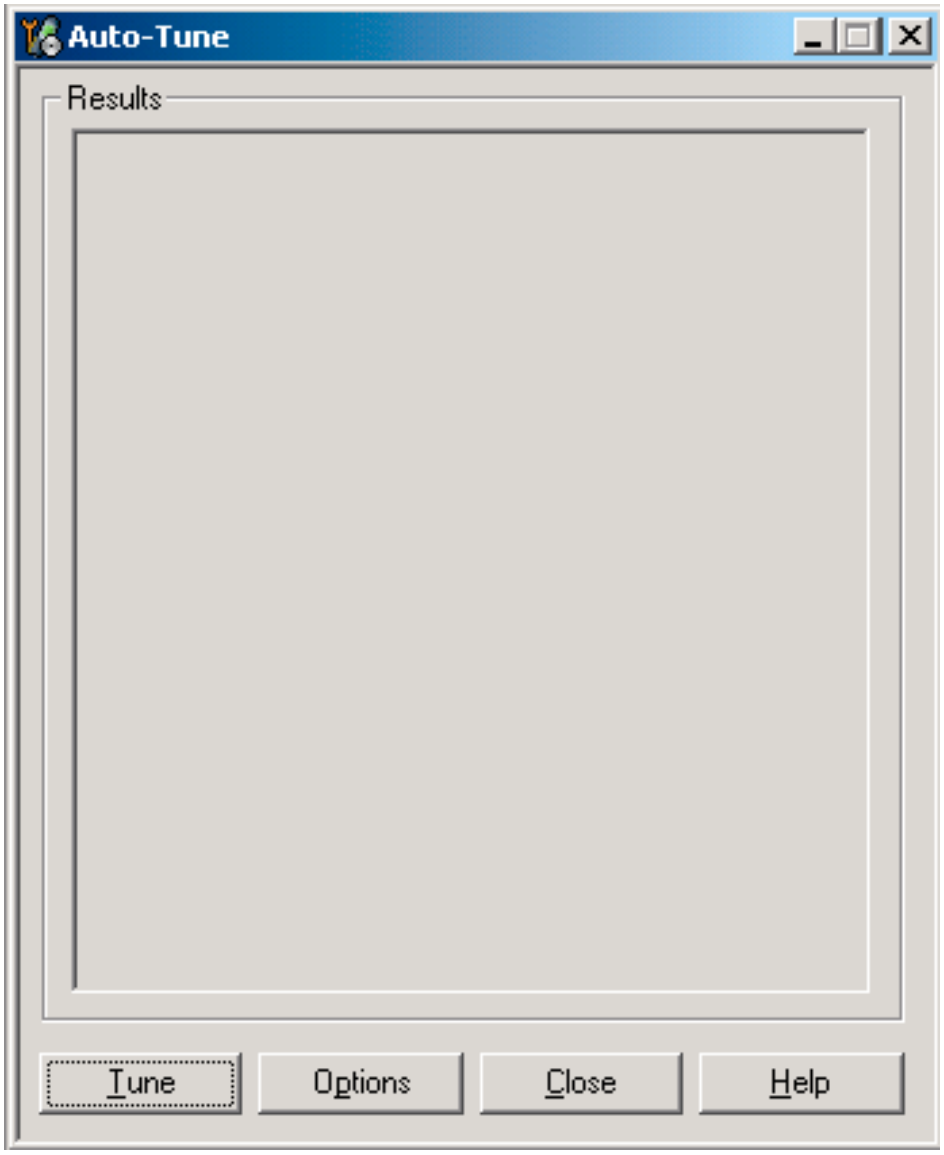


11. Change the phone's RF adapter from WCDMA port to GSM port.
    To complete the RF autotuning, click OK.


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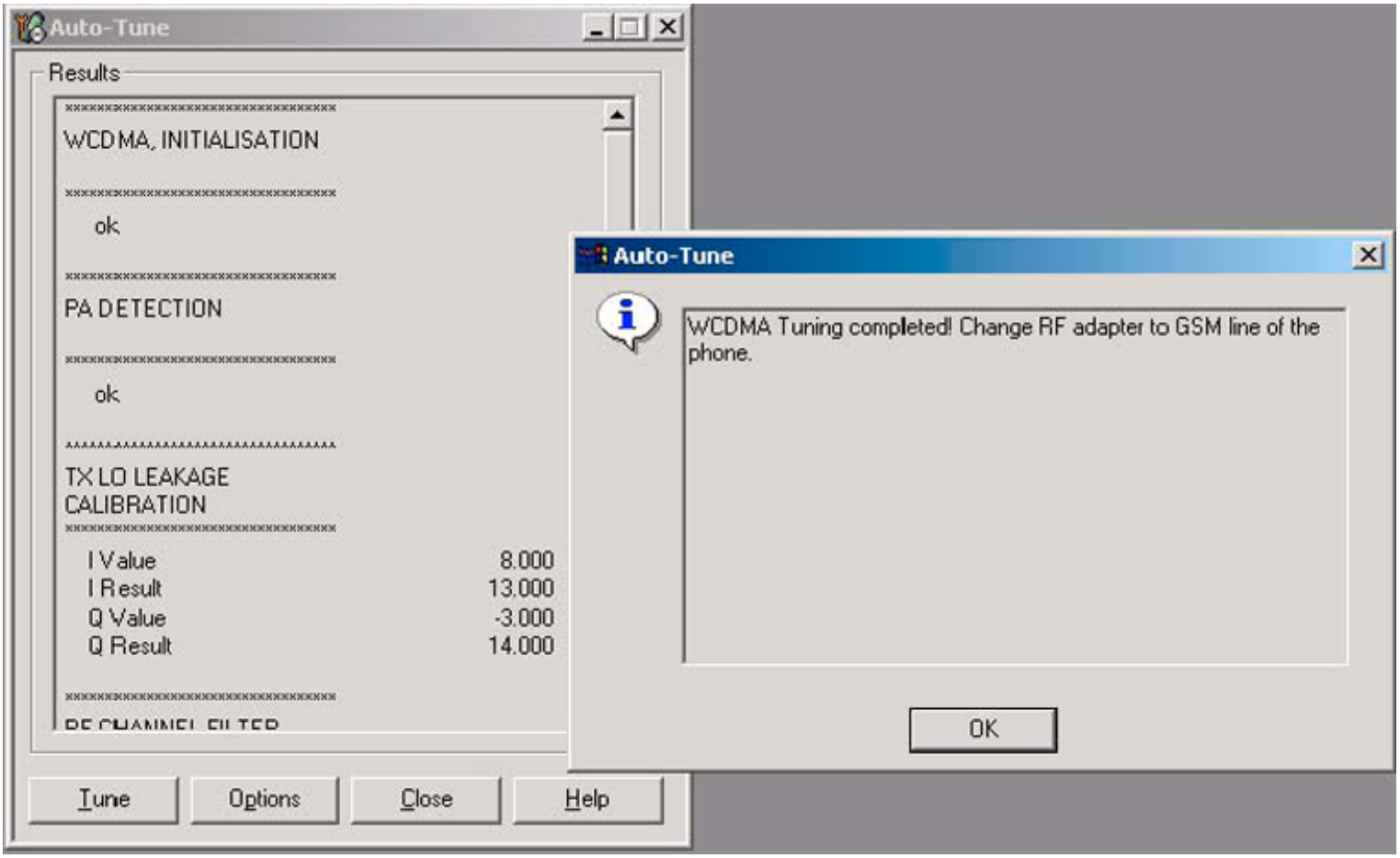


## Results

"Autotuning completed successfully" message appears.


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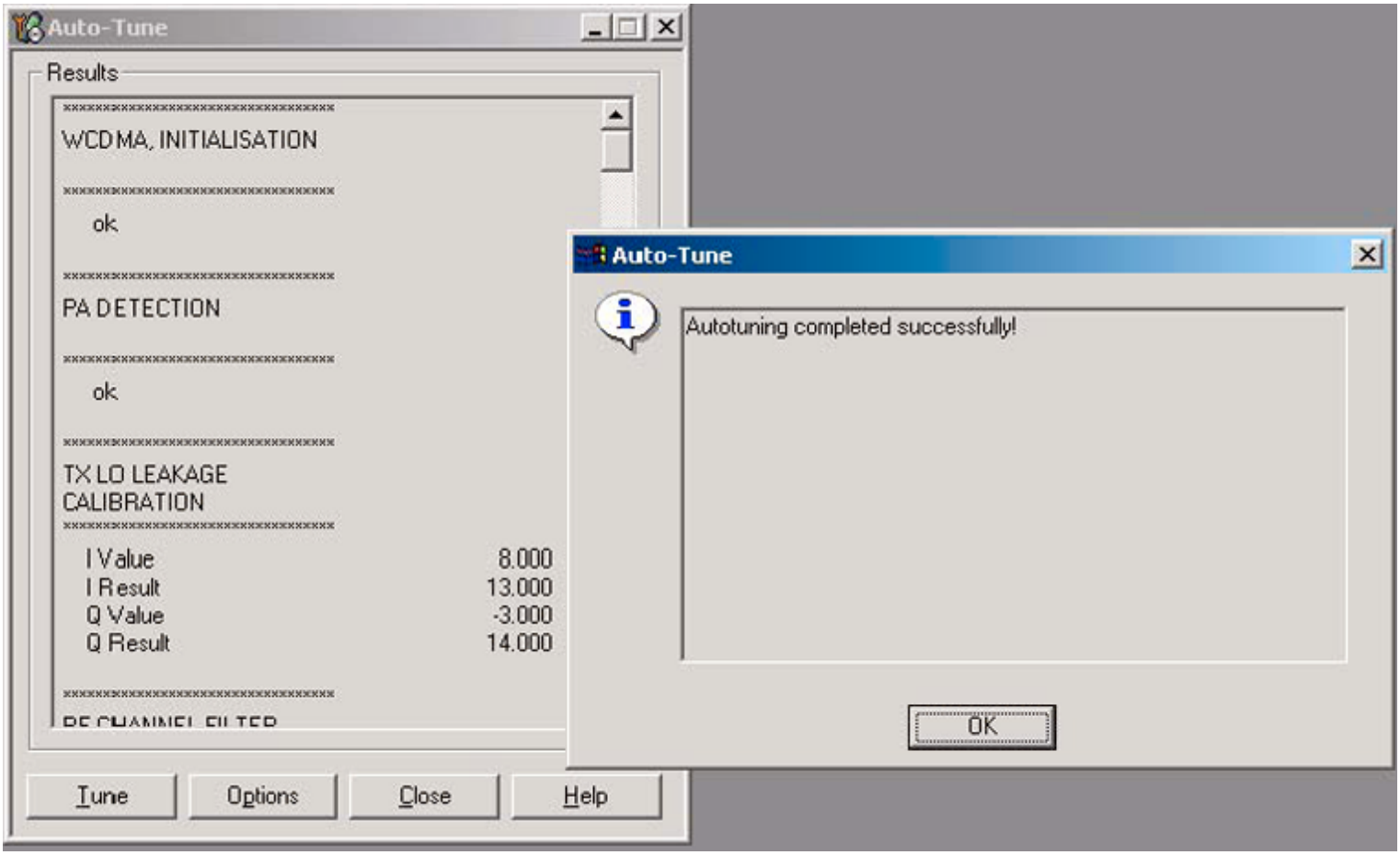


## System mode independent manual tunings

### RF channel filter calibration

#### Context

Rx channel filter calibration tunes Rx and Tx ASICs' internal low pass filters that limit the bandwidth of BB IQ signals.

One common calibration is made for GSM and WCDMA.

**Table 4 RF channel filter calibration tuning limits**

| | Min | Typ | Max | Unit |
|---|---|---|---|---|
| TX filter | 0 | 10 | 31 | |
| RX filter | 0 | 16 | 31 | |

#### Steps

1. From the dropdown menus, set "System mode" to Local and "Operating mode" to WCDMA, GSM or Dual.
2. From the Tuning menu, choose *RF Channel Filter Calibration*.
3. Click Tune.
4. Click Write.

   Saves tuned values to the PMM area.
5. To close the tuning window, click Close.


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### Results

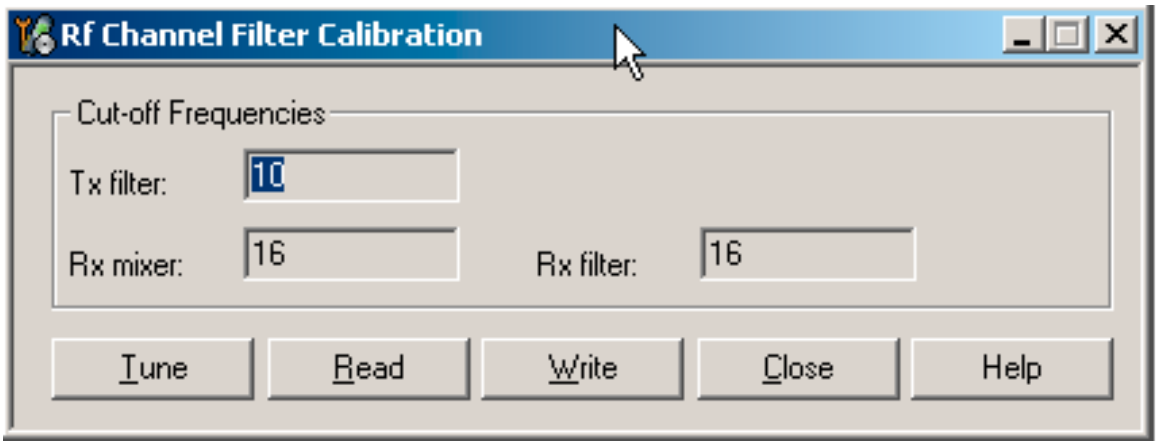


Figure 74 RF channel filter calibration typical values

## PA detection

### Context

PA detection procedure asks DSP to detect which PA manufacturer is used for GSM and WCDMA PAs.

If PA is changed or if PMM data is corrupted, PA detection has to be performed before Tx tunings.

### Steps

1. From the dropdown menus, set "System mode" to Local and "Operating mode" to WCDMA, GSM or Dual.
2. From the Tuning menu, choose PA Detection.
3. Click Tune.
4. Check that the detected PA manufacturers are corresponding to the actual chips on the board.
5. To end the procedure, click Close.

## Temperature sensor calibration

### Context

There is a temperature sensor integrated into VINKU ASIC. VINKU provides DC-voltage, which is temperature dependent.

Temperature sensor calibration is done in room temperature, in which offset caused by VINKU variation and AD-converter inside RETU are nullified.

The module is able to do this calibration by itself, no external equipment is needed.

The temperature of the module and components must be 23 +/-2 degrees.

### Steps

1. From the dropdown menus, set "Operating mode" to Local and "System mode" to WCDMA, GSM or Dual.
2. From the Tuning menu, choose WCDMA -> Temperature Sensor Calibration.


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3. Click Tune.

**Table 5 Temperature sensor calibration tuning limits**

| Min | Typ | Max | Unit |
|---|---|---|---|
| -20 | -4 | 20 | $^0$C |

A popup window appears asking: “Save Values to PM”. Click “Yes”

4. To finish the calibration, click Close.

## GSM receiver tunings

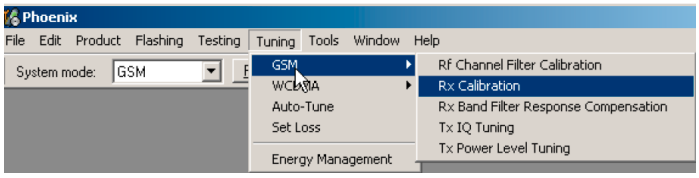
### Rx calibration (GSM)

#### Context

Rx Calibration is used to find out the real gain values of the GSM Rx AGC system and tuning response of the AFC system (AFC D/A init value and AFC slope)

#### Steps

1. Connect module jig’s GSM connector to signal generator.
2. From the dropdown menus, set "Operating mode" to Local, "System mode" to GSM, and Band to GSM900.
3. From the Tuning menu, choose GSM -> Rx Calibration.




4. Check the “Load from Phone” check box and clear the “Save to Phone” checkbox.
5. From the Band dropdown menu, choose GSM900.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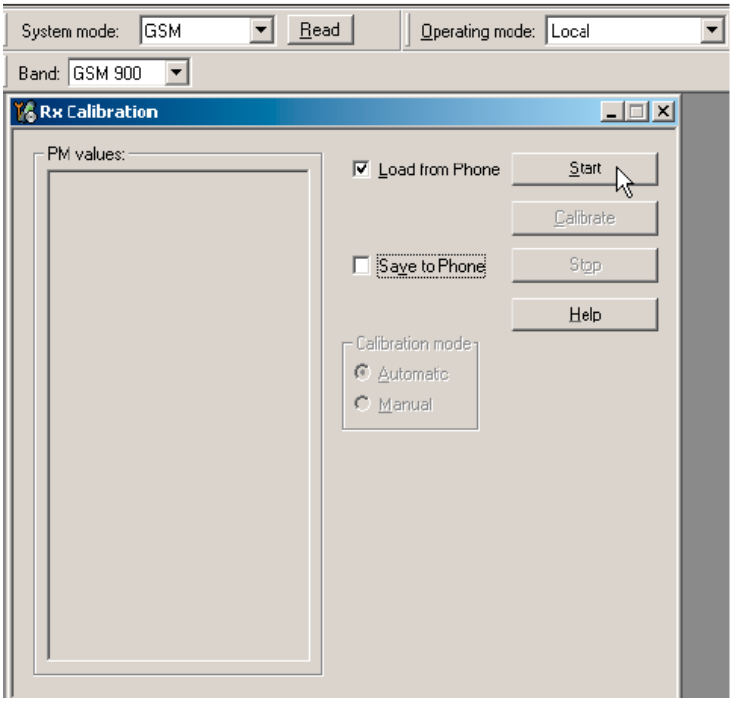
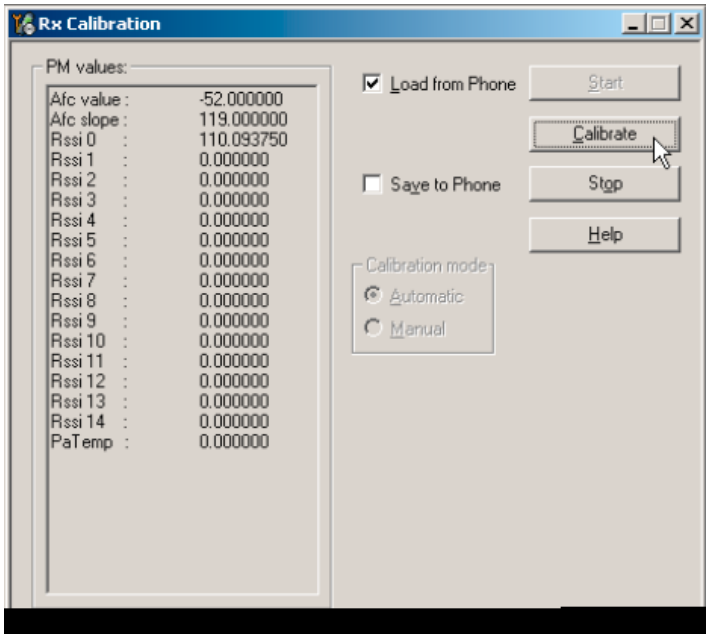
6. Click Start (if it not active already).




7. Click Calibrate.




8. Connect signal generator to the phone and set frequency and amplitude as instructed in the "Rx Calibration with band EGSM900" popup window.

   The calibration uses a non-modulated CW signal. Increase the signal generator level by cable attenuation and module jig probe attenuation!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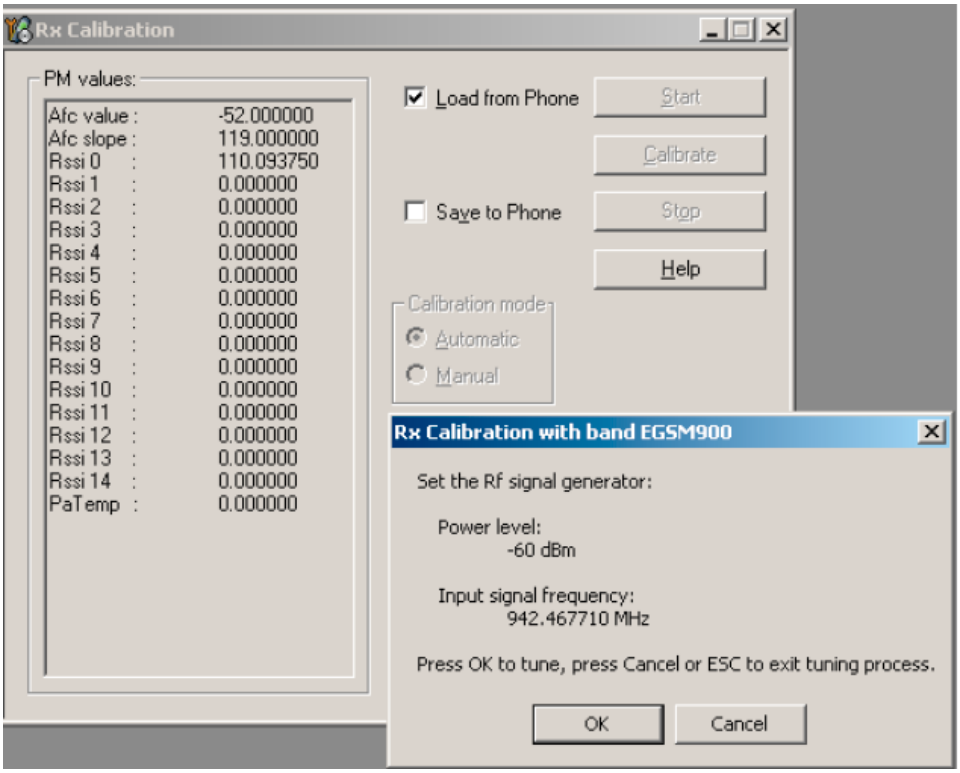


9. To perform tuning, click OK.
10. Check that the tuning values are within the limits specified in this table:

**Table 6 RF tuning limits in Rx calibration**

| GSM900 | Min | Typ | Max | Unit |
|---|---|---|---|---|
| AFC Value | -200 | -105 62 | 200 | |
| AFC slope | 0 | 122 | 200 | |
| RSSI0 | 106 | 107 110 | 114 | dB |
| GSM1800 | | | | |
| RSSI0 | 104 | 104 109 | 114 | dB |
| GSM1900 | | | | |
| RSSI0 | 104 | 104 109 | 114 | dB |


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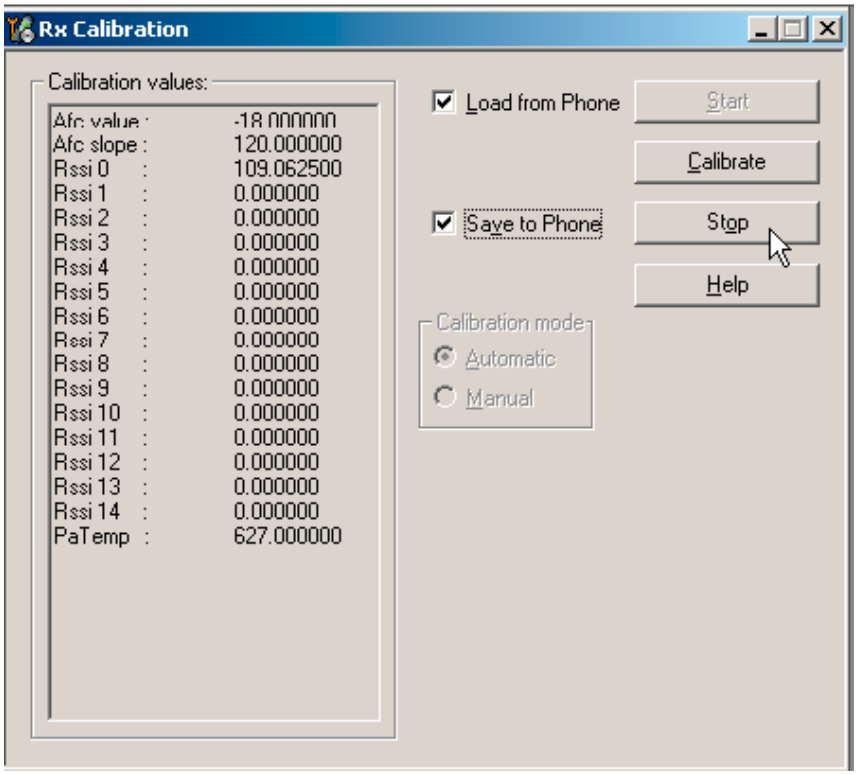
11. To save values to the phone, check the "Save to Phone" check box and click Stop.




### Next action

Repeat steps 3 to 8 for GSM1800 and GSM1900

## Rx band filter response compensation (GSM)

### Before you begin

Rx calibration must be done before the Rx Band Filter Response Compensation

### Context

In each GSM Rx band, there's a band rejecting filter in front of HINKU front end. The amplitude ripple caused by these filters causes ripple to the RSSI measurement and therefore calibration is needed.

The calibration has to be repeated for each GSM band.

### Steps

1. Connect module jig's GSM connector to signal generator.
2. From the dropdown menus, set "Operating mode" to Local, "System mode" to GSM, and Band to GSM900.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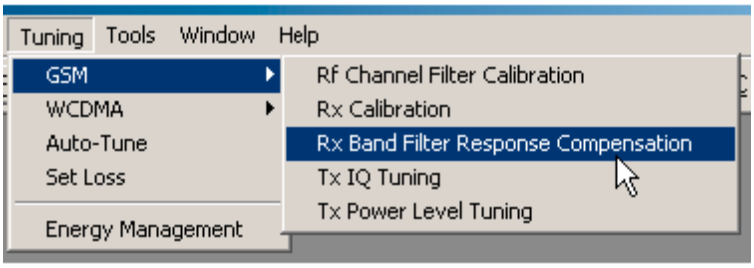
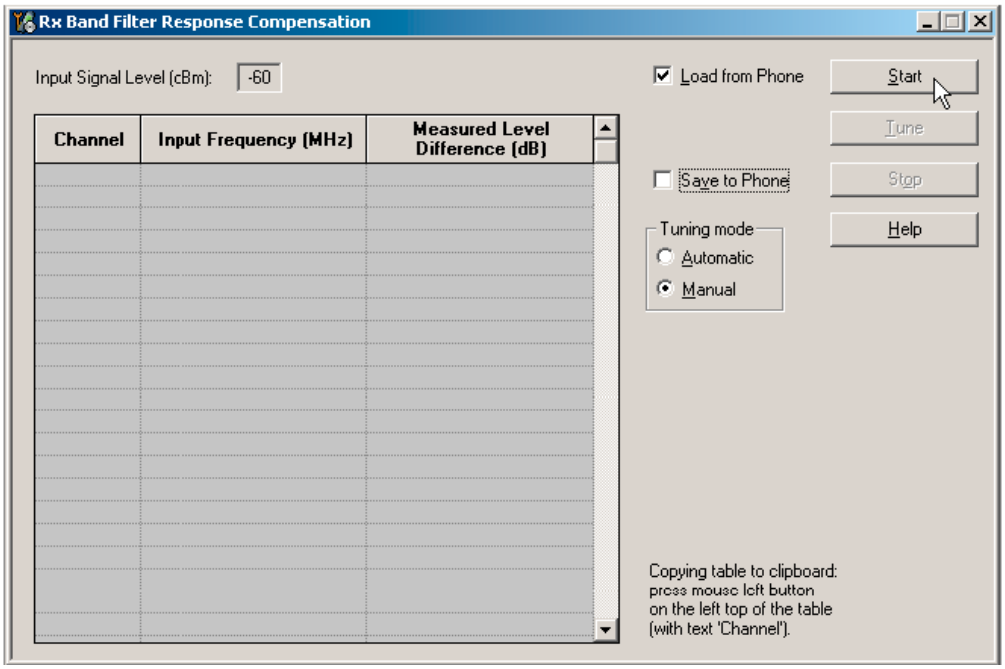
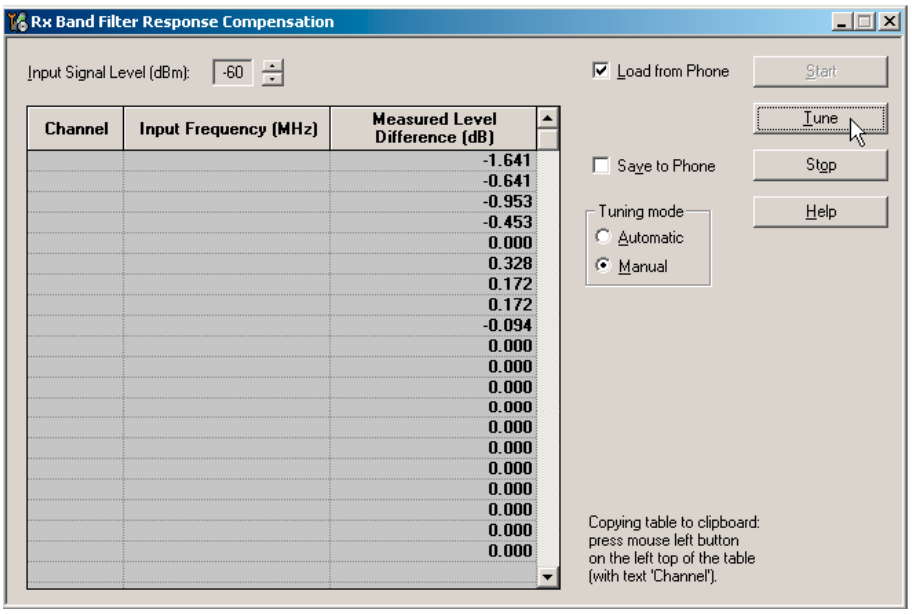
3. From the Tuning menu, choose GSM -> Rx Band Filter Response Compensation.




4. Check “Manual” and “Load from Phone” check boxes. Clear “Save to Phone” check box
5. Click Start.




6. Click Tune.





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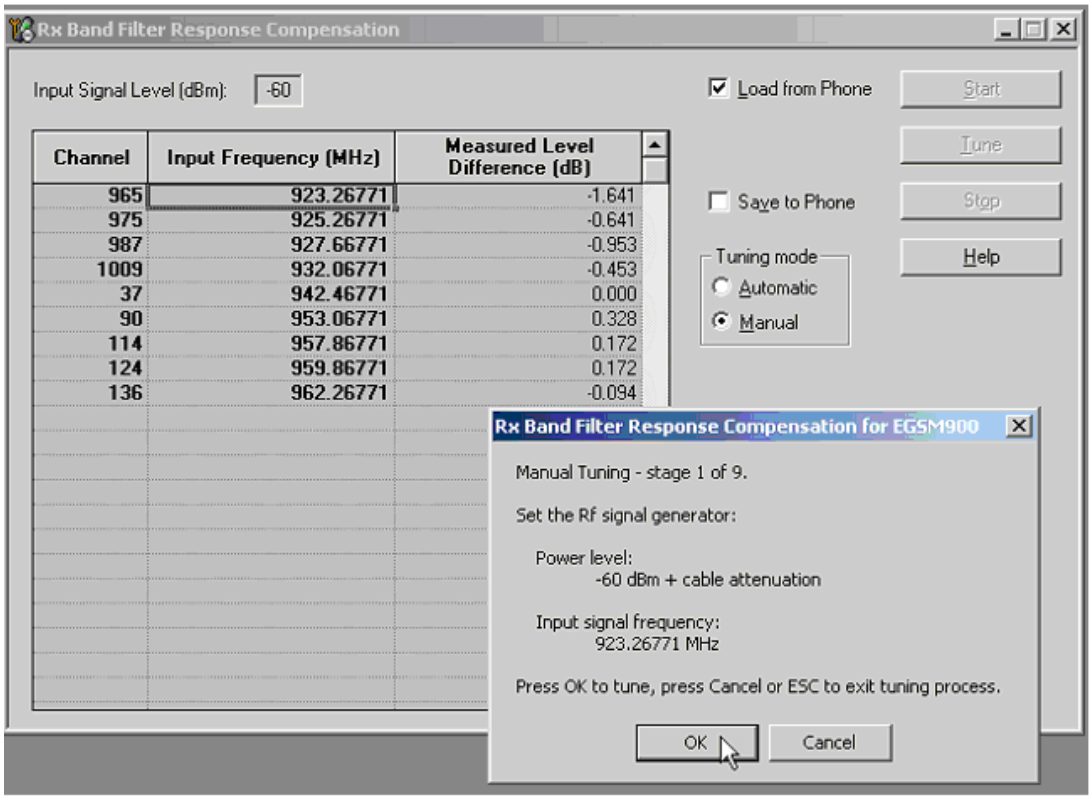
7. Connect signal generator to the phone and set frequency and amplitude as instructed in the "Rx Band Filter Response Compensation for EGSM900" popup window.




8. To perform tuning, click OK.
9. Go through all 9 frequencies.
10. Check that the tuning values are within the limits specified in this table:

| | Min | Typ | Max | Unit |
|---|---|---|---|---|
| **GSM900** | | | | |
| Ch. 965 / 923.26771 MHz | -10 | -1 | 5 | dB |
| Ch. 975 / 925.26771 MHz | -3 | 0 | 5 | dB |
| Ch. 987 / 927.66771 MHz | -3 | 0 | 5 | dB |
| Ch. 1009 / 932.06771 MHz | -3 | 0 | 5 | dB |
| Ch. 37 / 942.46771 MHz | -3 | 0 | 5 | dB |
| Ch. 90 / 953.06771 MHz | -3 | 0 | 5 | dB |
| Ch. 114 / 957.86771 MHz | -3 | 0 | 5 | dB |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| | Min | Typ | Max | Unit |
|---|---|---|---|---|
| Ch. 124 / 959.86771 MHz | -3 | 0 | 5 | dB |
| Ch. 136 / 962.26771 MHz | -10 | -1 | 5 | dB |
| **GSM1800** | | | | |
| Ch. 497 / 1802.26771 MHz | -10 | -1 | 5 | dB |
| Ch. 512 / 1805.26771 MHz | -3 | 0 | 5 | dB |
| Ch. 535 / 1809.86771 MHz | -3 | 0 | 5 | dB |
| Ch. 606 / 1824.06771 MHz | -3 | 0 | 5 | dB |
| Ch. 700 / 1842.86771 MHz | -3 | 0 | 5 | dB |
| Ch. 791 / 1861.06771 MHz | -3 | 0 | 5 | dB |
| Ch. 870 / 1876.86771 MHz | -3 | 0 | 5 | dB |
| Ch. 885 / 1879.86771 MHz | -3 | 0 | 5 | dB |
| Ch. 908 / 1884.46771 MHz | -10 | -1 | 5 | dB |
| **GSM1900** | | | | |
| Ch. 496 / 1927.06771 MHz | -10 | -1 | 5 | dB |
| Ch. 512 / 1930.26771 MHz | -3 | 0 | 5 | dB |
| Ch. 537 / 1935.26771 MHz | -3 | 0 | 5 | dB |
| Ch. 586 / 1945.06771 MHz | -3 | 0 | 5 | dB |
| Ch. 661 / 1960.06771 MHz | -3 | 0 | 5 | dB |
| Ch. 736 / 1975.06771 MHz | -3 | 0 | 5 | dB |
| Ch. 794 / 1986.66771 MHz | -3 | 0 | 5 | dB |
| Ch. 810 / 1989.86771 MHz | -3 | 0 | 5 | dB |


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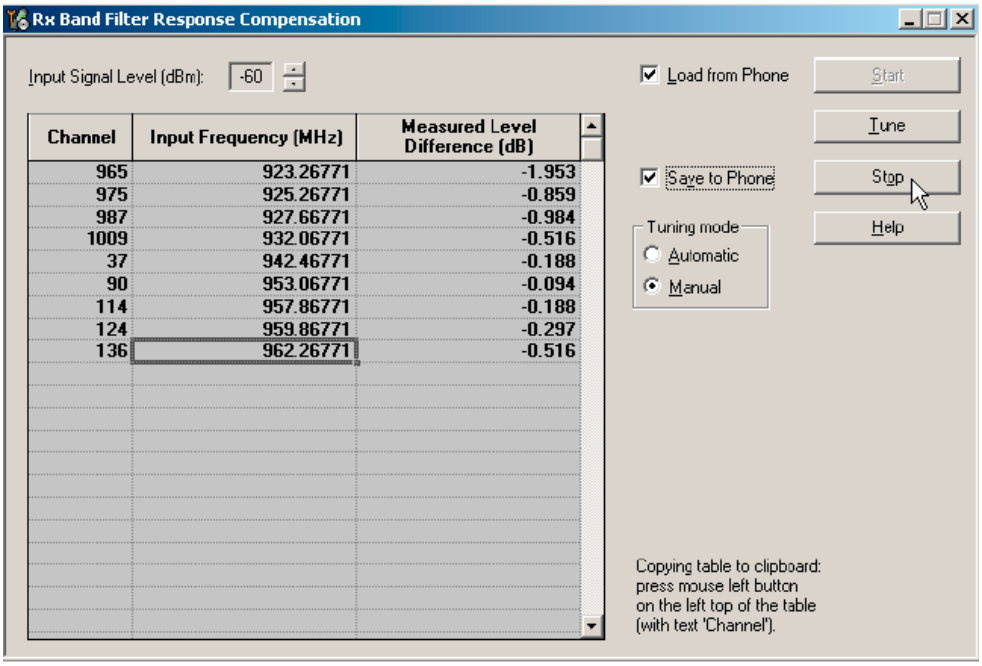
| | Min | Typ | Max | Unit |
|---|---|---|---|---|
| Ch. 835 / 1994.86771 MHz | -10 | -1 | 5 | dB |

11. Check the "Save to Phone" check box and click Stop if the values are within the limits.




## Next action

Repeat the steps 4 to 10 for GSM1800 and GSM1900.

## Rx AM suppression (GSM)

### Context

Rx AM suppression is used to tune the AM suppression capabilities of the GSM receiver.

AM suppression is related to ability of the receiver to operate when there is disturbing AM modulated signal near the received channel signal frequency.

RFIC has tunable compensation circuit which has an effect on the AM suppression ability.

In the tuning, a continuous useful signal + AM modulated signal 10MHz above current channel is fed to the antenna. RFIC control word values are iterated until a minimum RSSI signal is found.

### Steps

1. Connect module jig's GSM connector to signal generator.
2. From the dropdown menus, set "Operating mode" to Local, "System mode" to GSM, and Band to GSM900.
3. From the Tuning menu, choose GSM -> Rx AM Suppression.
4. Check the Automatic check box.
5. Connect signal generator to phone according to the frequency and modulation parameters displayed in the tuning window:

| | |
|---|---|
| Frequency | 952.46771MHz / 1852.86771MHz / 1970.06771 MHz (depending on the band used) |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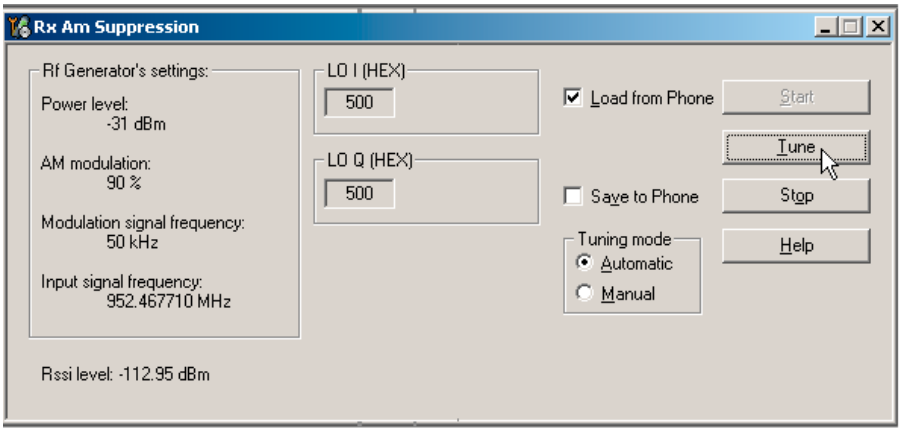
| | |
|---|---|
| Power level | -25 dBm / -26 dBm / -29 dBm (increase by cable and jig attenuations) |
| Modulation | AM |
| AM modulation depth | 90% |
| Modulation signal | 50 kHz sinewave (or 15 kHz if 50 kHz is not available) |

6. Click Start.
7. Click Tune.




8. Check that RSSI level value is between the limits presented in this table. If not, try clicking the Tune button again.

| GSM900 | Min | Typ | Max | Unit |
|---|---|---|---|---|
| RSSI level | -115 | | -90 | dB |
| GSM1800 | | | | |
| RSSI level | -115 | | -85 | dB |
| GSM1900 | | | | |
| RSSI level | -115 | | -100 | dB |

9. Make sure that the "Save to Phone" check box is checked and click Stop.

### Next action

Repeat steps 3 to 7 for GSM1800 and GSM1900

## GSM transmitter tunings

## Tx IQ tuning (GSM)

### Context

The Tx path branches to I and Q signals at RF I/Q modulator. Modulator and analog hardware located after it cause unequal amplitude and phase disturbance to I and Q signal paths. Tx IQ tuning tuning balances the I and Q branches.

Tx IQ tuning must be performed on all GSM bands. GSM1900 uses the same values as GSM1800.

### Steps

1. From the dropdown menus, set "Operating mode" to Local, "System mode" to GSM, and Band to GSM900.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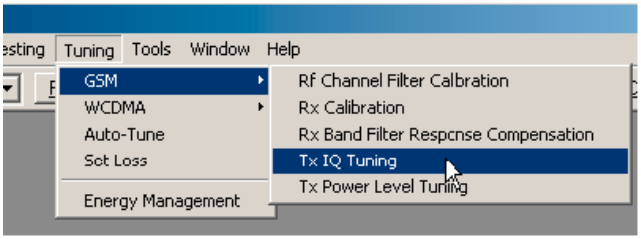
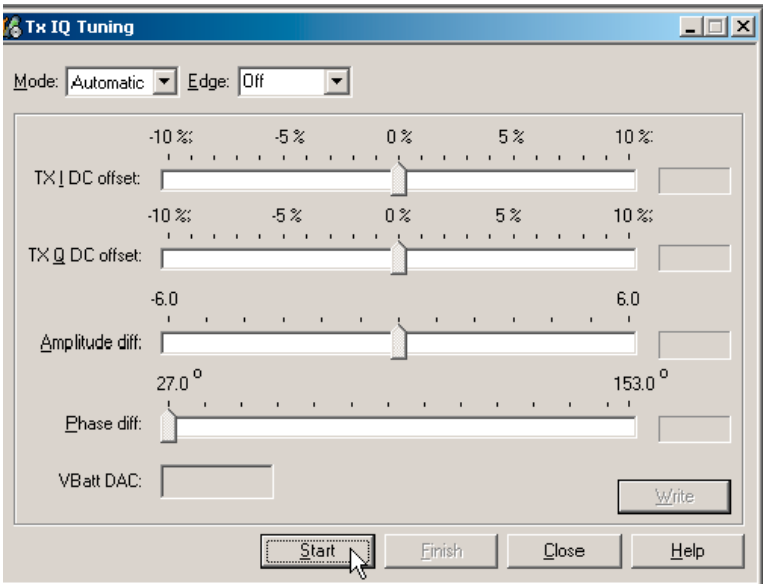
2. From the Tuning menu, choose GSM -> Tx IQ Tuning.



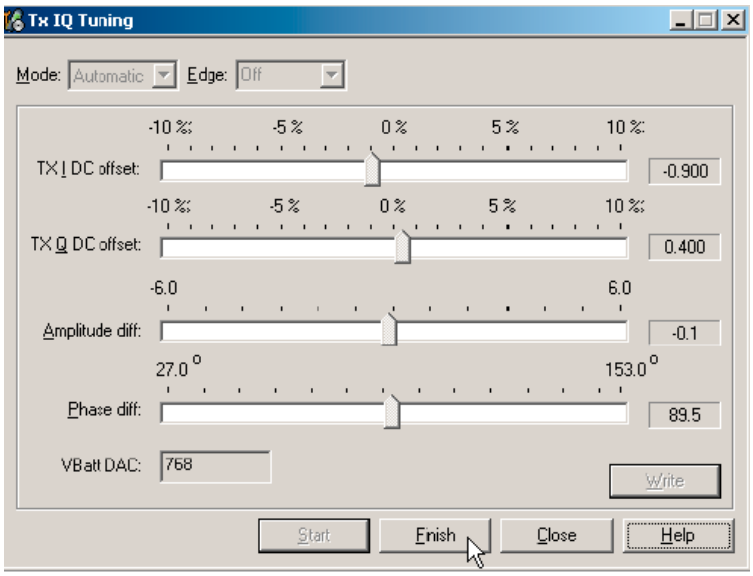

3. Set Mode to Automatic and Edge to Off.
4. Click Start.

   Wait until automatic tuning has finished and moved the sliders.

   Values are written to the phone memory automatically.




5. When the values have been written to the phone memory, click the Finish button to end the tuning.




6. Change band to GSM1800 and repeat steps 4 to 5.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7. Change band to GSM1900 and repeat steps 4 to 5.
8. To close the tuning window, click Close.

### Next action

Tuning sliders should be close to the center of the scale after the tuning and within the limits specified in the table below. If they are not within the limits, check Tx IQ quality manually.

| GSM900 | Min | Typ | Max | Unit |
|---|---|---|---|---|
| I DC offset / Q DC offset | -6 | -4 4 | 6 | dB |
| Ampl | -1 | 0 | 1 | dB |
| Phase | 85 | 90 | 95 | dB |
| GSM1800/GSM1900 | | | | dB |
| I/Q DC | -6 | 0.5 | 6 | dB |
| Ampl | -1 | 0 | 1 | dB |
| Phase | 95 | 100 | 110 | dB |

## Tx power level tuning (GSM)

### Context

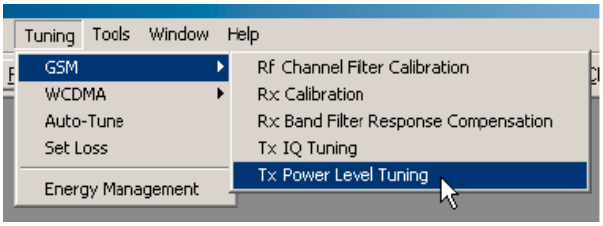
Because of variations at IC process and discrete component values, actual transmitter RF gain of each phone is different. Tx power level tuning is used to find out mapping factors called 'power coefficients'. These adjust the GSM transmitter output power to fulfill the specifications.

For EDGE transmission the bias settings of the GSM PA are adjusted in order to improve linearity. This affects the PA gain and hence the power levels have to be aligned separately for EDGE transmission.

Tx power level tuning has to be performed on all GSM bands.

### Steps

1. Connect the phone to a spectrum analyzer.
2. From the dropdown menus, set "Operating mode" to Local, "System mode" to GSM, and Band to GSM900.
3. From the Tuning menu, choose GSM -> Tx Power Level Tuning.




4. Set Mode to Automatic and Edge to Off.
5. Set the spectrum analyzer for power level tuning:

| | |
|---|---|
| Frequency | channel frequency (897.4MHz GSM900, 1747.8MHz GSM1800, 1880MHz GSM1900) |
| Span | 0 Hz |
| Sweep time | 2ms |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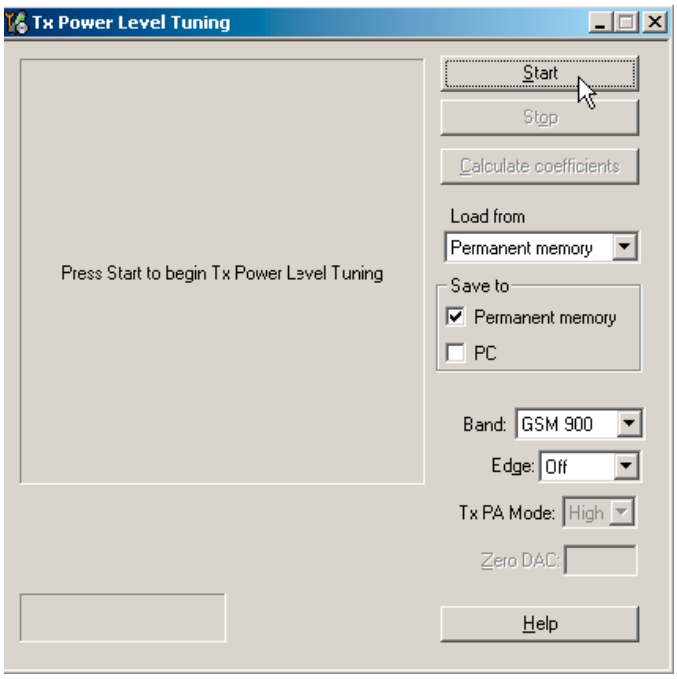
| | |
|---|---|
| Trigger | Video triggering (-10dBm) |
| Resolution BW | 3MHz |
| Video BW | 3MHz |
| Reference level offset | sum cable attenuation with module jig attenuation |
| Reference level | 33dBm |

A power meter with a peak power detector can be also used. Remember to take the attenuations in the account!

6. Click Start.





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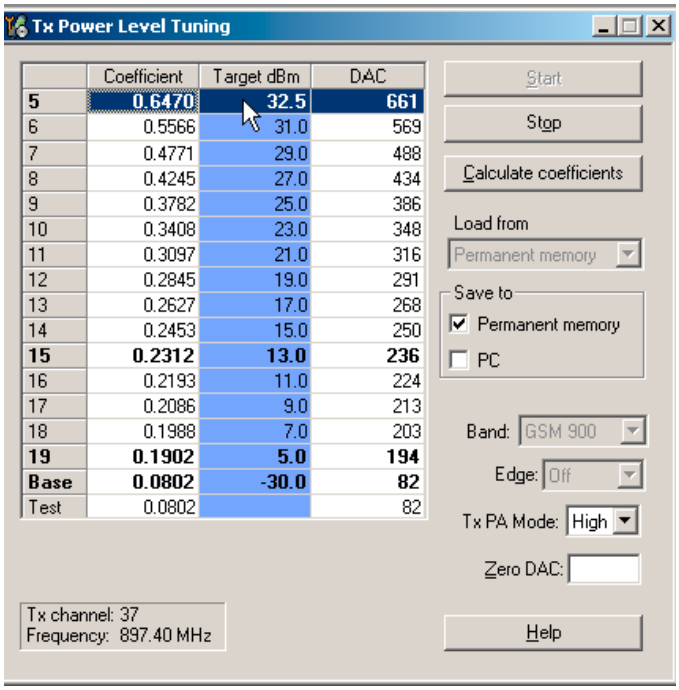
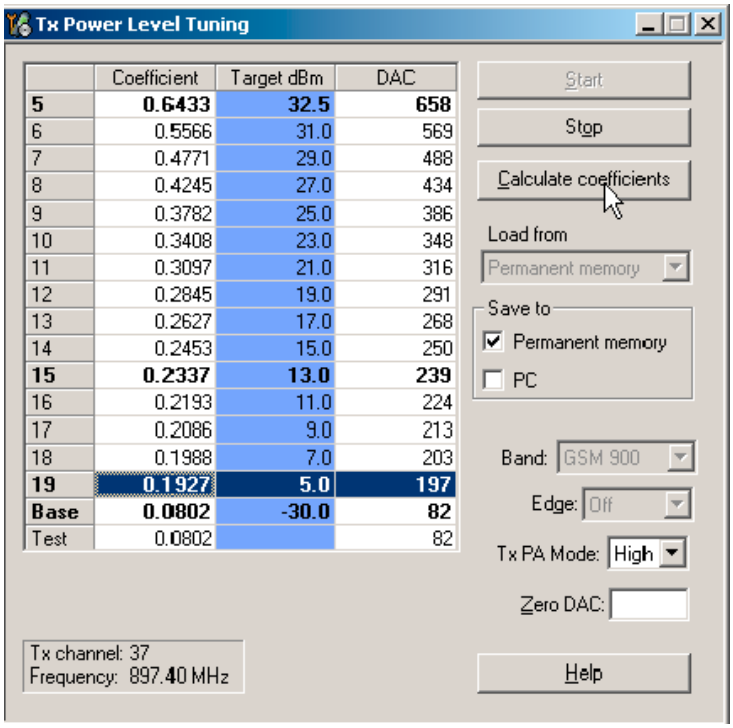
7. Adjust power levels 5, 15 and 19 to correspond the "Target dBm" column by pressing + or – keys.




8. Click Calculate Coefficients.




9. Check that the coeffiecient values are within the limits specified in the table below.

| | Min | Typ | Max | Unit |
|---|---|---|---|---|
| **GSM900 EDGE off** | | | | |
| PL5 coefficient | 0.45 | 0.626 | 0.73 | |
| PL15 coefficient | | 0.234 | | |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| | Min | Typ | Max | Unit |
|---|---|---|---|---|
| PL19 coefficient | 0.12 | 0.195 | 0.3 | |
| **GSM900 EDGE on** | | | | |
| PL8 coefficient | 0.35 | 0.419 | 0.6 | |
| PL15 coefficient | | 0.247 | | |
| PL19 coefficient | 0.12 | 0.204 | 0.3 | |
| **GSM1800 EDGE off** | | | | |
| PL0 coefficient | 0.45 | 0.51 | 0.7 | |
| PL11 coefficient | | 0.219 | | |
| PL15 coefficient | 0.12 | 0.185 | 0.3 | |
| **GSM1800 EDGE on** | | | | |
| PL2 coefficient | 0.35 | 0.394 | 0.6 | |
| PL11 coefficient | | 0.23 | | |
| PL15 coefficient | 0.12 | 0.194 | 0.3 | |
| **GSM1900 EDGE off** | | | | |
| PL0 coefficient | 0.45 | 0.482 | 0.7 | |
| PL11 coefficient | | 0.218 | | |
| PL15 coefficient | 0.12 | 0.184 | 0.3 | |
| **GSM1900 EDGE on** | | | | |
| PL2 coefficient | 0.35 | 0.377 | 0.6 | |
| PL11 coefficient | | 0.23 | | |
| PL15 coefficient | 0.12 | 0.193 | 0.3 | |

If the values are within the limits, check that the "Save to Phone Permanent Memory" check box is checked and click Stop.


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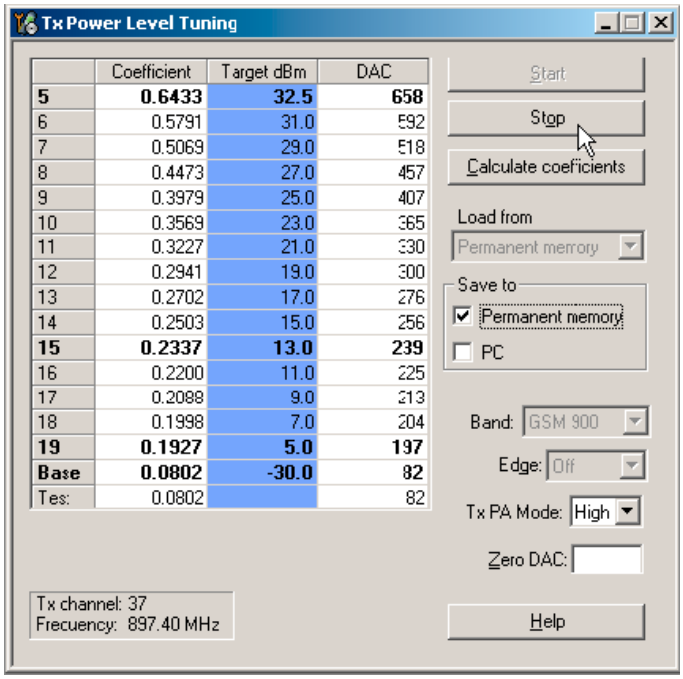
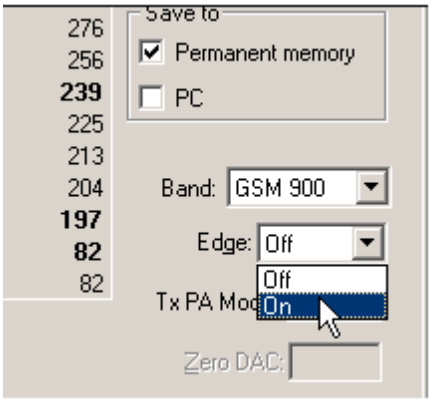



10. Set **Edge** mode on and start tuning again. Change video averaging to 50.




11. Tune EDGE power levels to the corresponding target power levels.

    Only power levels **8**, **15** and **19** are tuned in GSM900 and **2**, **10** and **15** in GSM1800/1900. The rest are calculated by clicking the Calculate Coefficients button. Check the coefficients against the RF tuning limits table presented in Step 9.
12. When the tuning is completed, click Stop.

### Next action

Repeat steps 4 to 9 for GSM1800 and GSM1900. On those bands only power levels **0**, **11** and **15** need to be tuned.

## WCDMA receiver tunings

### Rx AGC alignment (WCDMA)

### Context

Rx AGC alignment tuning is used to find out the real gain values of the WCDMA Rx AGC system and converters.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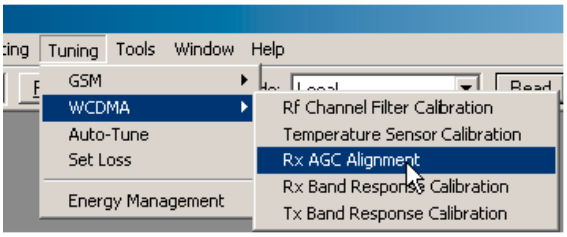
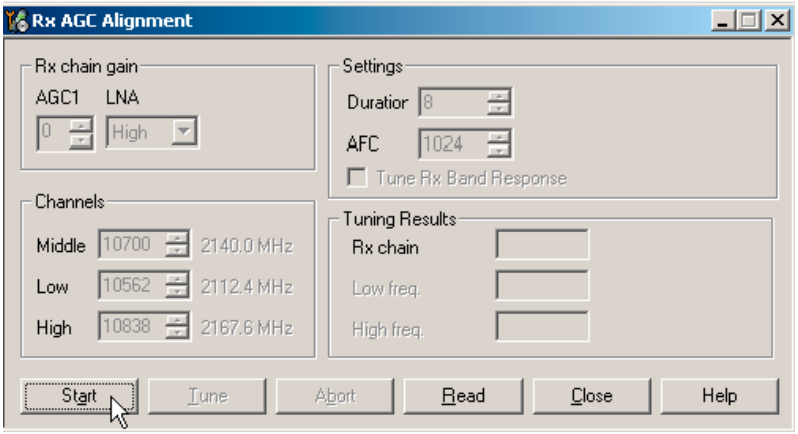
## Steps

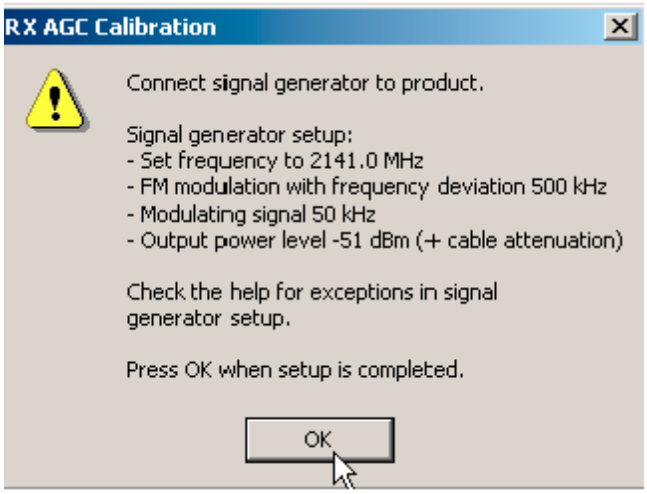
1. From the dropdown menus, set "Operating mode" to Local and "System mode" to WCDMA.
2. From the Tuning menu, choose WCDMA -> Rx AGC Alignment.




3. Click Start and Tune.




4. Setup the signal generator to correspond the values in the "RX AGC Calibration" pop-up window and click OK:


RX AGC Calibration
Connect signal generator to product.
Signal generator setup:
- Set frequency to 2141.0 MHz
- FM modulation with frequency deviation 500 kHz
- Modulating signal 50 kHz
- Output power level -51 dBm (+ cable attenuation)
Check the help for exceptions in signal generator setup.
Press OK when setup is completed.
OK

| | |
|---|---|
| Frequency: | 2141MHz |
| Level: | –51 dBm + cable and adapter attenuations |
| Modulation: | FM |
| Deviation: | 500 kHz |
| Modulation frequency: | 50 kHz |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5. Check that the “Rx Chain” value in “Tuning Results” is within the limits presented in the table below.

| | Min | Typ | Max | Unit |
|---|---|---|---|---|
| RX chain | -6 | 1.5 3.5 | 6 | dB |
| Low freq | -5 | -0.7 4.0 | 5 | |
| High freq | -5 | -0.7 4.0 | 5 | |

   i If the Rx gain is acceptable, click Yes to save the results to the phone.
6. To close the tuning window, click Close.

## Rx band response calibration (WCDMA)

### Context

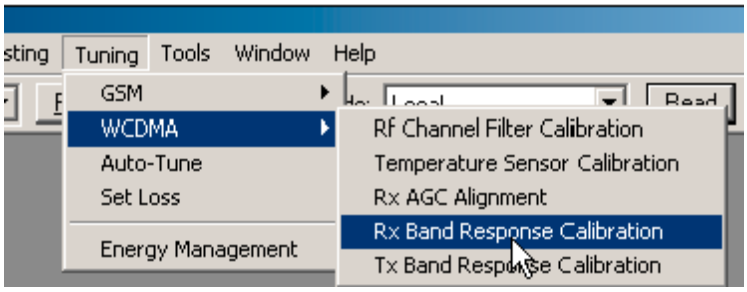
There is a band rejecting filter for each WCDMA Rx band between the front end LNA and the mixer of HINKU. The amplitude ripple caused by this filter causes ripple to the RSSI measurement and therefore Rx band response calibration is needed.

Rx band response calibration can be done in two different ways. If the signal generator in use supports frequency sweep table, the calibration can be done as a part of Rx calibration. If not, it is possible to calibrate all the necessary frequencies one by one.

The first set of steps shows how to perform the calibration without the signal generator sweep feature and the alternative steps give instructions how to perform the calibration if the signal generator supports frequency sweeps and the calibration can be performed within Rx AGC calibration.

### Steps

1. From the dropdown menus, set "Operating mode" to Local and "System mode" to WCDMA.
2. From the Tuning menu choose WCDMA -> Rx Band Response Calibration.





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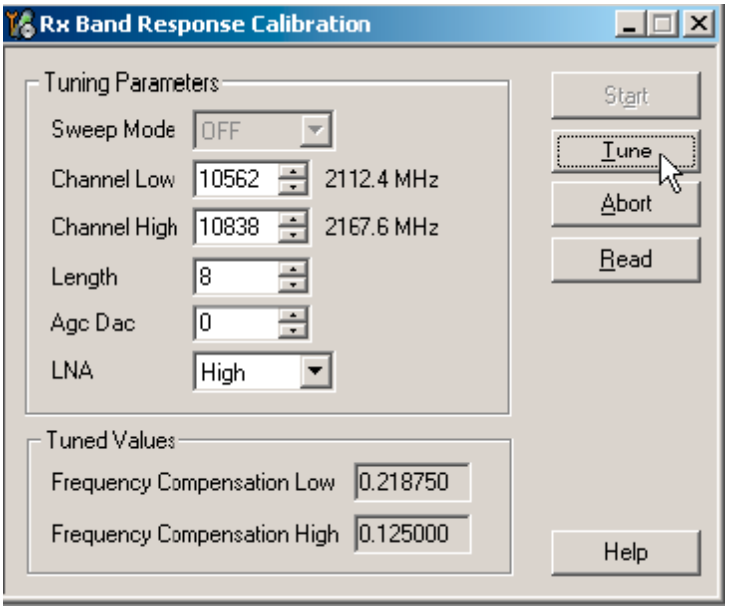
3. Click Start and Tune.




4. Setup the signal generator to correspond the values in the pop-up window:

| | |
|---|---|
| Frequency: | 2113.4MHz |
| Level: | –51 dBm + cable and adapter attenuations |
| Modulation: | FM |
| Deviation: | 500 kHz |
| Modulation frequency: | 50 kHz |

5. Click OK.
6. Change frequency to 2166.6 MHz and click OK.
7. Check that the tuned values are within the limits specified in the table below:

| | Min | Max |
|---|---|---|
| Frequency compensation low | -5 | +5 |
| Frequency compensation high | -5 | +5 |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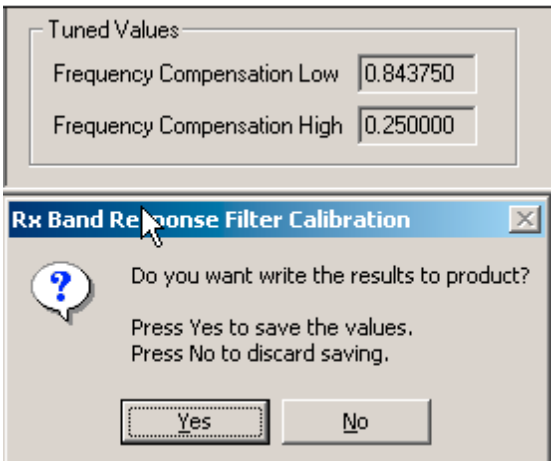
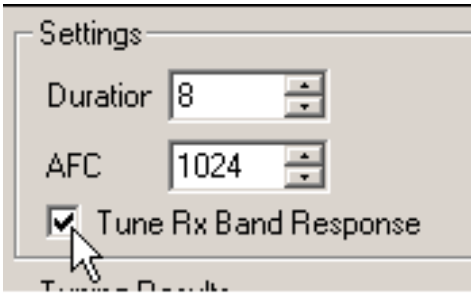
i If the values are OK, click Yes to save the values.




8. Close the tuning window.

## Alternative steps

- From the dropdown menus, set "Operating mode" to Local and "System mode" to WCDMA.
- From the Tuning menu, choose WCDMA -> Rx AGC Alignment.
- Click Start.
- Check the “Tune Rx Band Response” check box and click Tune.




- Setup the signal generator according to the values in the pop-up window:

| | |
|---|---|
| Frequency list: | 2113.4 MHz, 2141 MHz and 2166.6 MHz |
| Dwell time: | 2 ms |
| Sweep control: | Automatic continuous sweep |
| Level: | –51 dBm + cable and adapter attenuations |
| Modulation: | FM |
| Deviation: | 500 kHz |
| Modulation frequency: | 50 kHz |

- Click OK.
- Check that the “Rx chain” , “Low freq.” and “High freq.” values in the Tuning Results window are within the limits presented in the table below.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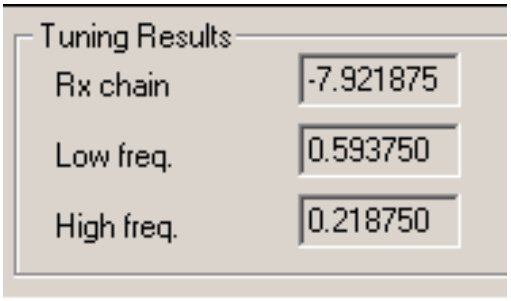


| | Min | Typ | Max | Unit |
|---|---|---|---|---|
| Rx chain | -6 | 1.5 3.5 | 6 | dB |
| Low freq | -5 | -0.7 4.0 | 5 | |
| High freq | -5 | -0.7 4.0 | 5 | |

- If the Rx gain is acceptable, click Yes to save the results to the phone.
- To close the window, click Close.

## WCDMA transmitter tunings

### Tx AGC & power detector (WCDMA)

#### Context

Tx AGC & power detector tuning has two purposes:

- to enable the phone to select the correct TxC value accurately in order to produce the required RF level
- to enable the phone to measure its own transmitter power accurately

There are two ways to perform the tuning. For an alternative method, see Alternative steps.

#### Steps

1. From the dropdown menus, set "Operating mode" to Local and "System mode" to WCDMA.
2. From the Tuning menu, choose WCDMA -> Tx AGC & Power Detector.
3. Click Start.
4. In the "Wide Range" pane, click Tune (the leftmost Tune button).
5. Setup the spectrum analyzer in the following way:

| | |
|---|---|
| Center frequency: | 1950.3 MHz |
| Span: | 0 Hz |
| Reference level offset: | Cable attenuations + adapter attenuation |
| Reference level: | 14 dBm |
| Input attenuation: | (20 dB) Manually select as small value as possible for the mentioned reference level to minimize the noise floor. |
| Resolution bandwidth: | 30 kHz |
| Video bandwidth: | 30 kHz |
| Sweep time: | 20 ms |
| Detector: | **RMS detector** |


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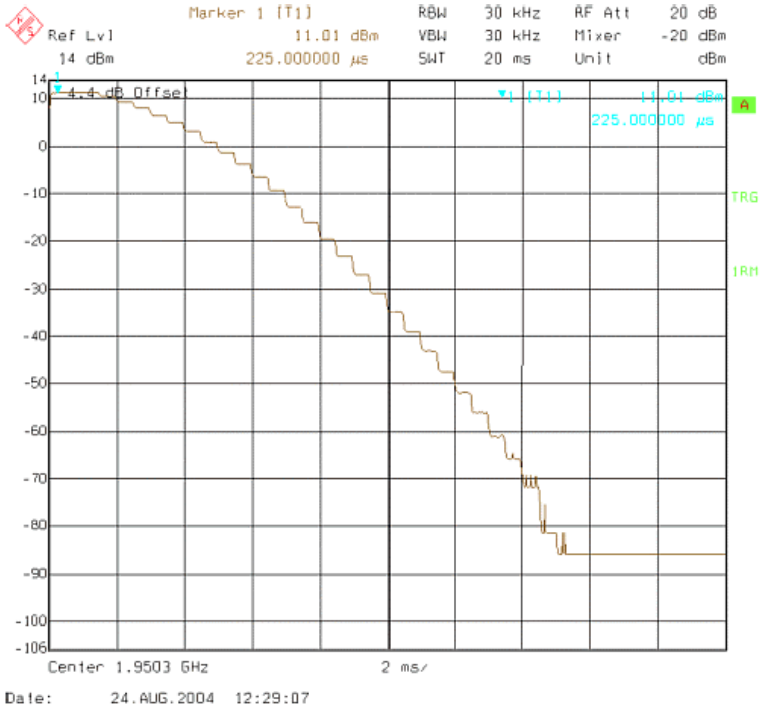
| | |
|---|---|
| Average: | No |
| Trigger: | Video |
| Trigger level: | 0 dBm |
| Marker: | 250 us |
| Marker step: | 500 us |

6. After setting the spectrum analyzer, click OK.
7. Measure the power levels with a marker.

   Take the first measurement from 250 us after the trigger, the second from 750 us, the third on 1225 us and so on in every 500 us until the table is filled.

   **Note:** It must be possible to measure power levels down to –68 dBm. The measured power levels must be monotonously decreasing.

   Make sure that the marker is not measuring the level of noise spike on lower levels.





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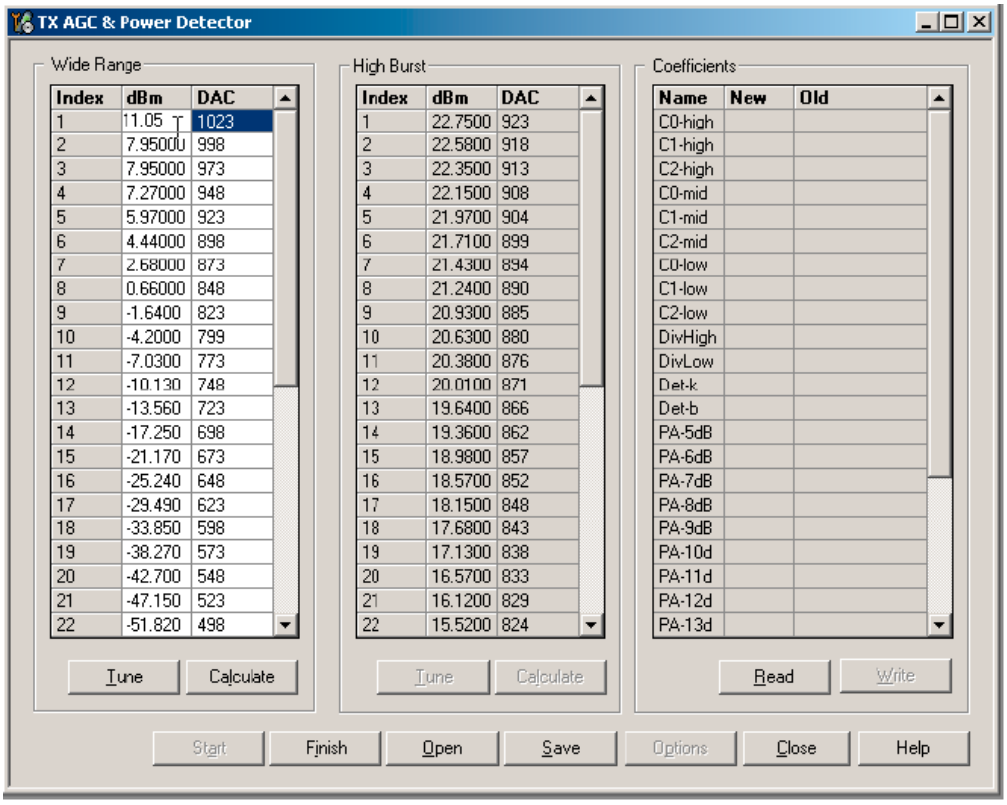
8. Fill in the power level values (in dBm) to the Wide Range table.




9. In the Wide Range pane, click Calculate.
10. In the High Burst pane, click Tune.
11. Setup the spectrum analyzer with the following settings:

| | |
|---|---|
| Center frequency: | **1950 MHz** |
| Span: | 0 Hz |
| Reference level offset: | Cable attenuations + adapter attenuation |
| Reference level: | **24 dBm** |
| Input attenuation: | Automatic |
| Resolution bandwidth: | 5 MHz |
| Video bandwidth: | 5 MHz |
| Sweep time: | 20 ms |
| Detector: | **RMS detector** |
| Average: | No |
| Trigger: | Video |
| Trigger level: | 0 dBm |
| Marker: | 250 us |
| Marker step: | 500 us |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12. Measure the power levels with a marker.

    Take the first measurement from 250 us after the trigger, the second from 750 us, third on 1225 us and so on in every 500 us until the table is filled.

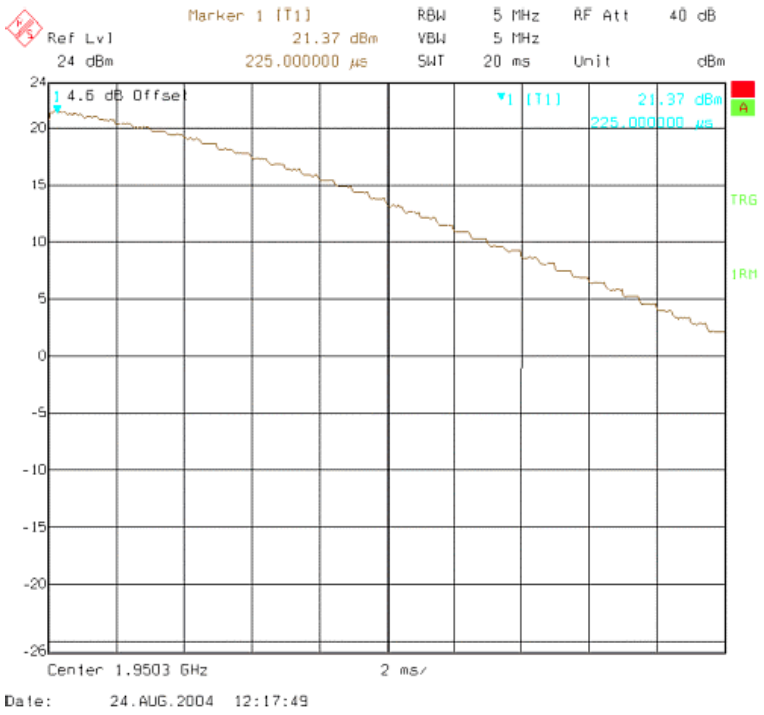


Figure 75 High burst measurement

13. In the High Burst pane, click Calculate.
14. Check that the calculated values are within the limits specified in the table below:

| | Min | Typ | Max | Unit |
|---|---|---|---|---|
| C0-high | -0.5 | | 5 | |
| C1-high | -50 | | 50 | |
| C2-high | 400 | | 900 | |
| C0-mid | -0.7 | | 0.7 | |
| C1-mid | 0 | | 50 | |
| C2-mid | 400 | | 900 | |
| C0-low | -4 | | 4 | |
| C1-low | -400 | | 440 | |
| C2-low | -10000 | | 15000 | |
| Det-k | 0 | | 800 | |
| Det-b | -1000 | | 1000 | |

15. To save the coefficients to the phone, click Write.
16. To close the tuning window, click Close.
17. From the Testing menu, choose WCDMA -> Tx Control.


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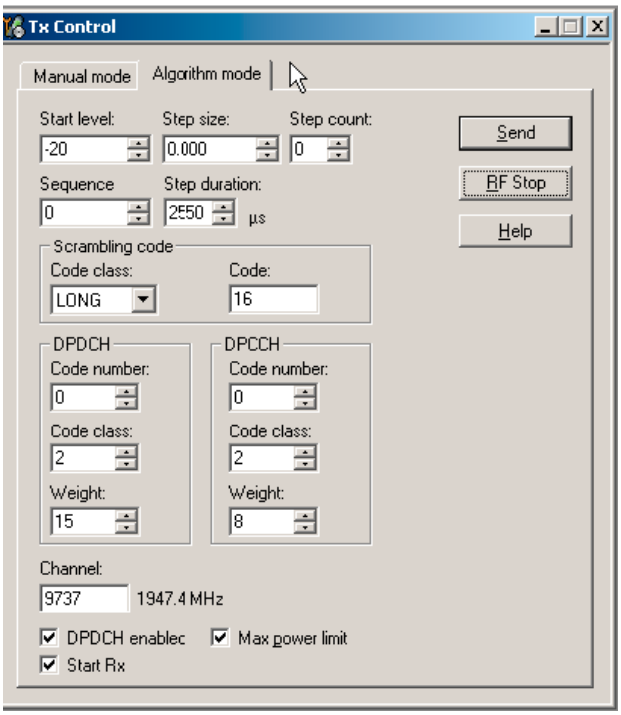
18. Select the Algorithm mode tab.




19. Write the target power level 25 dBm to the "Start level" line and check the "Max power limit" check box (detector calibration check).
20. Setup the spectrum analyzer with the following settings:

| | |
|---|---|
| Center frequency: | 1947.4 MHz |
| Span: | 0 Hz |
| Reference level offset: | Cable attenuations + adapter attenuation |
| Reference level: | **24 dBm or -20 dBm depending on the measured level** |
| Input attenuation: | Automatic |
| Resolution bandwidth: | 5 MHz |
| Video bandwidth: | 5 MHz |
| Sweep time: | 20 ms |
| Detector: | **RMS detector** |
| Average: | No |
| Trigger: | Free run |

21. Click Send.
22. Measure the WCDMA output power.

    It should be around 21 dBm.
23. Click RF Stop and uncheck the "Max power limit" check box.
24. Repeat steps 19 to 23 for levels +19, +7, 0, -20 and –40 dBm levels.

    The measured output power may not differ more than +-2 dB from the requested value at level +19dBm and no more than +-4dB on lower levels.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Remember to stop the RF before sending new data.

### Alternative steps

- Measure the wide range levels normally and write down the levels that are possible to measure.
- Click Finish.
- Click Options.
- Change the first wide range DAC value to 573 and change the number of tuning steps to 21.
- Change the spectrum analyzer reference level to –20 dBm and adjust the input attenuator to the lowest value possible.
- In the Wide Range pane, click Tune and fill in the rest of values starting from the 19th level.

## Tx band response calibration (WCDMA)

### Context

Tx band response calibration is required to get compensation parameters for DSP algorithm in order for it to handle frequency response variations (caused by SAW filter, PA and duplexer unidealities) in open loop power control and maximum power limitation situations.

### Steps

1. From the dropdown menus, set "Operating mode" to Local and "System mode" to WCDMA.
2. From the Tuning menu, choose WCDMA -> Tx Band Response Calibration.
3. Setup the spectrum analyzer according to the following settings:

| | |
|---|---|
| Frequency: | 1950.3 MHz |
| Span: | 100 MHz |
| Reference level offset: | Cable attenuations + adapter attenuation |
| Reference level: | 30 dBm |
| Input attenuation: | Default |
| Resolution bandwidth: | more than 4.7 MHz (i.e. 5MHz) |
| Video bandwidth: | more than 4.7 MHz (i.e. 5MHz) |
| Trigger: | Free run |
| Markers: | 1922.4 MHz, 1950.0 MHz and 1977.6 MHz |

4. Click Start and OK.
5. In the "Mid Channel Power Level" pane, adjust the power level to 21.0 dBm.
6. Click Accept and OK.
7. Read the marker power level on the low channel and fill it in to the “Low Power Level” line.
8. Click Accept and OK.
9. Read the marker power level on the high channel and fill it in to the “High Power Level” line.
10. Check that the tuned values are within the limits presented in the table below. If they are OK, click yes.

| | Min | Max |
|---|---|---|
| TX Freq Comp (the first and last value) | -4 | +4 |

11. Close the tuning window.


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## Tx LO leakage (WCDMA)

### Context

The purpose of Tx LO leakage tuning is to minimize the carrier leakage of the IQ-modulator which is caused by the DC offset voltages in the Tx IQ-signal lines and in the actual IQ-modulator. The tuning improves WCDMA Tx AGC dynamics at low power levels. A self-calibration routine selects the best combination for internal control words in order to produce minimum LO leakage.

### Steps

1. From the dropdown menus, set "Operating mode" to Local and "System mode" to WCDMA.
2. From the Tuning menu, choose WCDMA -> Tx LO Leakage.
3. Click Tune.
4. To end the tuning, click Close.


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# Appendix A: Additional RF Troubleshooting Instructions

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## 1. USING THESE INSTRUCTIONS

The following sections include lots of headings and subheadings that are asking simple positive style questions.

For example heading 4.2 asks if the phone does measure RSSI-values correctly in GSM-bands. If the answer is "Yes" then user should go to the next heading on the same level (heading number that has as many decimal numbers as the heading 4.2) In our example case moving to the chapter 4.3. If the answer is "No" then user should go to one heading level deeper in hierarchical system meaning the chapter 4.2.1 in our example case.

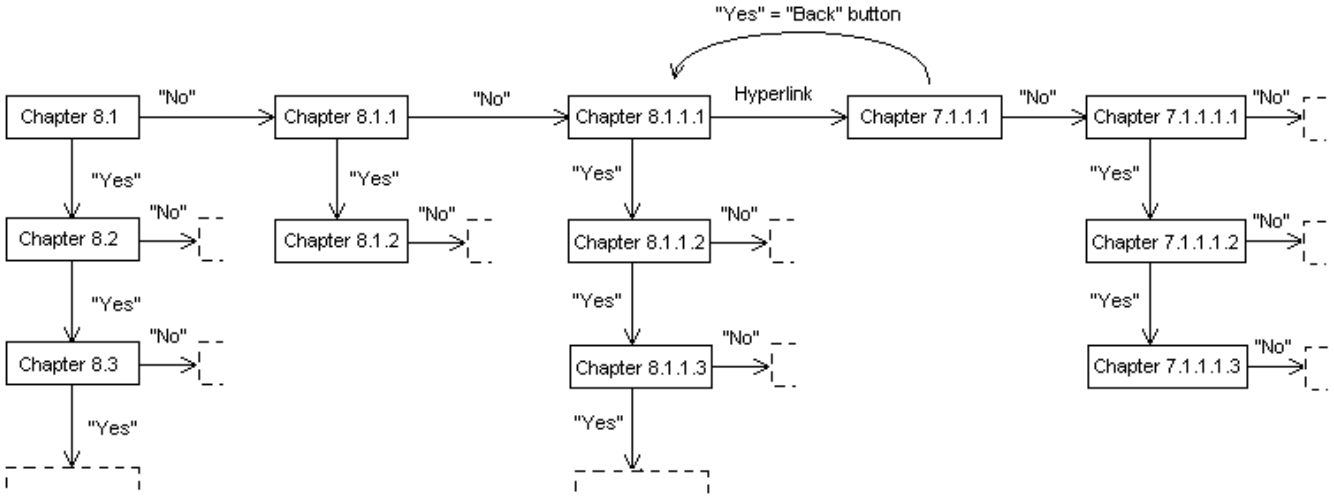


**Figure 1 Use of this troubleshooting manual presented with an example. Notice that real chapter numbers are not used.**



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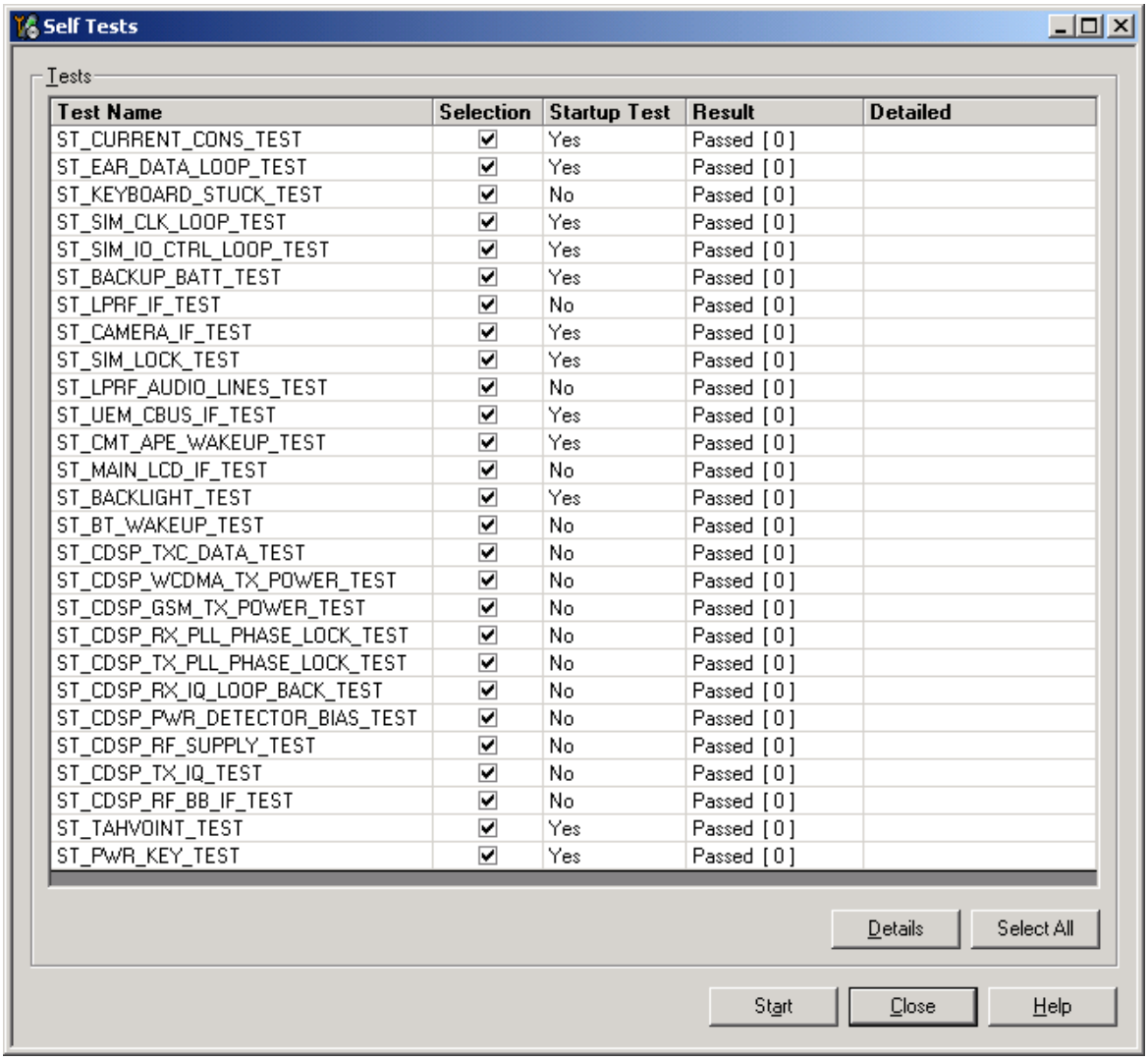
## 2. RF SELF TESTS

The RF part of Nokia 6630 is equipped with self test functionality which tests most of RF-BB interface signals and some parts of RF circuitry. Self-tests are designed to detect faults on some critical parts, but they cannot prove that everything is OK even if all the self-tests are passed.
Self-tests can be run with Phoenix service software. Tests can return pass/fail result and detailed measurement data and error codes in fail case. Select “Testing” -> “Self Tests” from the Phoenix menu. Select appropriate RF self tests and run them with “Start”-button. Notice that self tests should be run in “Local”-mode (change “Operating Mode” to “Local” in Phoenix before running self tests). For service tool usage




instructions refer to the chapter “Service Tools and Service Concepts”.



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If one or more self tests show fail results (for example: “minor” or “fatal”) more detailed error codes can be read from the phone with “Details” button. Error codes are shown in hexadecimal format, but notice that all returned hexadecimal values are not necessarily useful in RF troubleshooting because some of the self-tests return also different kind of measurement information together with “real” error codes. If self-tests are not passed, please refer to following subchapters for detailed troubleshooting information.

**IMPORTANT! ST_CDSP_RF_SUPPLY_TEST is the most important self-test and the reason for the supply voltage self test fail should always be found before reasons for other self test fails are checked!**

## 2.1 RX PLL phase lock self test (ST_CDSP_RX_PLL_PHASE_LOCK_TEST)

This self-test verifies the functionality of the RX VCO (G7500) and Hinku (N7500) synthesizer. Test can fail if communication with Hinku is not working, Hinku, RX VCO, balun (T7501) or loop filter components are broken or poorly soldered.

Tested signals: VBAT_ASIC, VDIG, VR1, VR1RX, VCP1, RFBUSDAT, RFBUSCLK, RFBUSENA, RXRESETX

Error code for this self-test is given in format:

- *0xyy, 0xzz*

,where 0xyy, 0xzz part is the total error code: 0xyyzz

| Error code | Bit mask | Reason | Actions |
|---|---|---|---|
| 0x0001 | ----------1 | *Communication with Hinku failed.* | See section 3.1.1.1.1 “RF operating voltage VBAT_ASIC?” |
| 0x0002 | ----------1- | | See section 3.2.2.3 “Hinku (N7500) regulator voltage VR1 ok?”<br><br>Does RF-BB interface self test also fail? See section 3.1.1.1.2 “RFBUS signals ok?”<br><br>Faulty Hinku (N7500) or RAP3G (D2800)? |
| 0x0004 | ----------1-- | *Hinku PLL is not locked.* | See section 3.1.1.1.1 “RF operating voltage VBAT_ASIC?”<br><br>See section 3.2.2.3 “Hinku (N7500) regulator voltage VR1 ok?”<br><br>RX VCO, balun T7501 or loop filter faulty?<br>Check following steps: See section |



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| | | | |
|---|---|---|---|
| | | | 3.2.2.7 "Is there RF power in the RX VCO output at all?" and section 3.2.2.8 "Is RX VCO RF-signal coming to the Hinku at all?"<br>See section 3.2.2.9 "Is RX VCO frequency as expected?"<br><br>Faulty Hinku (N7500) or RAP3G (D2800)? |

Please, refer to chapter 2.11 "Error Code Interpretation Examples", if more information about error code interpretation is needed.

## 2.2 RF-BB interface (ST_CDSP_RF_BB_IF_TEST)

RF-BB interface self test verifies if the RF control bus is functional and the functionality of digital parts of the RF ASICs is ok.

Tested signals: VBAT_ASIC, VDIG, VREFRF01, VXO, RFBUSDAT, RFBUSCLK, RFBUSENA, RXRESETX, TXRESETX

Error code for this self-test is given in format:

- *0xyy, 0xzz*

,where 0xyy, 0xzz part is the total error code: 0xyyzz

| Error code | Bit mask | Reason | Actions |
|---|---|---|---|
| 0x0001 | ----------1 | *Incorrect version number read from the RX IC.* | See section 3.1.1.1.1 "RF operating voltage VBAT_ASIC?"<br><br>See section 3.1.1.1.2 "RFBUS signals ok?"<br><br>Faulty Hinku (N7500) or RAP3G (D2800)? |
| 0x0002 | ----------1- | *RX IC is not reset correctly.* | See section 3.1.1.1.1 "RF operating voltage VBAT_ASIC?"<br><br>Check RXRESETX signal.<br>See section 3.1.1.1.2 "RFBUS signals ok?" |



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| | | | |
|---|---|---|---|
| | | | Faulty Hinku (N7500) or RAP3G (D2800)? |
| 0x0004 | ----------1-- | *Register write-read cycle failed.* | See section 3.1.1.1.1 "RF operating voltage VBAT_ASIC?"<br><br>Check RXRESETX signal.<br>See section 3.1.1.1.2 "RFBUS signals ok?"<br><br>Faulty Hinku (N7500) or RAP3G (D2800)? |
| 0x0008 | ----------1--- | *Incorrect version number read from the TX IC.* | See section 3.1.1.1.1 "RF operating voltage VBAT_ASIC?"<br><br>Check RFBUS signal levels, see section 3.1.1.1.2 "RFBUS signals ok?"<br><br>Faulty Vinku (N7501) or RAP3G (D2800)? |
| 0x0010 | ----------1---- | *TX IC is not reset correctly.* | See section 3.1.1.1.1 "RF operating voltage VBAT_ASIC?"<br><br>Check TXRESETX signal<br>See section 3.1.1.1.2 "RFBUS signals ok?"<br><br>Faulty Vinku (N7501) or RAP3G (D2800)? |
| 0x0012 | ----------1----- | *Register write-read cycle failed.* | See section 3.1.1.1.1 "RF operating voltage VBAT_ASIC?"<br><br>Check TXRESETX signal<br>See section 3.1.1.1.2 "RFBUS signals ok?"<br><br>Faulty Vinku (N7501) or RAP3G (D2800)? |

**All six error codes:**

=> If VBAT_ASIC voltage is correct: Most probably caused by faulty RAP3G (D2800) but also faulty Hinku (N7500) or Vinku (N7501) can cause this error.

Please, refer to chapter 2.11 "Error Code Interpretation Examples", if more information about error code interpretation is needed.



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## 2.3 RX IQ loop back self test (ST_CDSP_RX_IQ_LOOP_BACK_TEST)

This test verifies if the RX-IQ signal path from Hinku (N7500) to the baseband circuitry is operational.

Tested signals: VBAT_ASIC, RXQP, RXQN, RXIP, RXIN, VREFCM, TXIP, TXIN, RFBUS

Error code for this self-test is given in format:

- *0xyy, 0xzz, MeasResult1, MeasResult2*

,where 0xyy, 0xzz part is the main part of the error code: 0xyyzz

| Error code | Bit mask | Reason | Actions |
|---|---|---|---|
| 0x0001 | ----------1 | *Test can not be executed* | Internal SW error. Should not happen.<br><br>Does RF-BB interface self test also fail? See section 3.1.1.1.2 "RFBUS signals ok?" |
| 0x0002 | ----------1- | | |
| 0x0004 | ----------1-- | | |
| 0x0008 | ----------1--- | | |
| 0x0010 | ----------1---- | *Measured IQ power is under limit* | Check TXIP, TXIN, RXQP, RXQN, RXIP, RXIN, VREFCM signals.<br><br>Check following steps: See section 3.2.2 "Are RX-IQ signal waveforms and levels correct?"<br><br>See section 3.2.3 "Is RAP3G ASIC getting ok VREFCM-signal from Hinku (N7500)? Signal level ok?" Hinku (N7500), Vinku (N7501) or RAP3G faulty?<br><br>Check the following steps if 2.4. "TX IQ self test (ST_CDSP_TX_IQ_TEST)"shows also fail: see section 3.1.1.1.1 "RF operating voltage VBAT_ASIC?" Vinku (N7501) or RAP3G (D2800) faulty or soldering not ok? Retu (N2200) AD converter? |



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Please, refer to chapter 2.11 "Error Code Interpretation Examples", if more information about error code interpretation is needed.

## 2.4 TX IQ self test (ST_CDSP_TX_IQ_TEST)

This test verifies if TX-IQ lines from RAP3G (D2800) to Vinku (N7501). Test returns pass of fail result and measured test voltages from each of four lines. The voltage should be equal on each line and more than 1.2V.

Tested signals: VBAT_ASIC, TXIP, TXIQ, TXQP, TXQN, DAC_REF1, RFBUS

Error code for this self-test is given in format:

- *0xyy, 0xzz, MeasResult1, MeasResult2, ...*

,where 0xyy, 0xzz is the main part of the error code: 0xyyzz

| Error code | Bit mask | Reason | Actions |
|---|---|---|---|
| 0x0001 | ----------1 | *TXIP signal level under threshold* | If only one of the signals is faulty, check Vinku (N7501) and RAP3G (D2800) soldering.<br><br>If the result is fail with all four IQ-signals check following steps: 3.1.1.1.1 "RF operating voltage VBAT_ASIC?" Retu (N2200) AD converter can be faulty, RAP3G (D2800) faulty or soldering bad, Vinku (N7501) faulty, (DAC_REF1 signal)? |
| 0x0002 | ----------1- | *TXIN signal level under threshold* | |
| 0x0004 | ----------1-- | *TXQP signal level under threshold* | |
| 0x0008 | ----------1--- | *TXQN signal level under threshold* | |
| 0x0010 | ----------1---- | *CBUS read or write access failed* | Retu access problem. Internal SW error. Should not happen. |

Please, refer to chapter 2.11 "Error Code Interpretation Examples", if more information about error code interpretation is needed.

## 2.5 TX PLL phase lock self test (ST_CDSP_TX_PLL_PHASE_LOCK_TEST)

This self-test verifies the functionality of the TX VCO (G7502) and Vinku (N7501) synthesizer. Test can fail if communication with Vinku is not working, Vinku, TX VCO, balun (T7503) or loop filter components are broken or poorly soldered.

Tested signals: VBAT_ASIC, VDIG, VR1, VCP2, RFBUSDAT, RFBUSCLK, RFBUSENA, TXRESETX

Error code for this self-test is given in format:

- *0xyy, 0xzz*



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,where 0xyy, 0xzz part is the total error code: 0xyyzz

| Error code | Bit mask | Reason | Actions |
|---|---|---|---|
| 0x0001 | ----------1 | *Communication with Vinku failed.* | 3.1.1.1.1 "RF operating voltage VBAT_ASIC?" |
| 0x0002 | ----------1- | | 3.1.1.1.3 "Vinku (N7501) regulator voltages VREG1, VREG2 ok?"<br><br>Is RF-BB interface self-test result also fail? 3.1.1.1.2 "RFBUS signals ok?"<br><br>Faulty Vinku (N7501) or RAP3G (D2800)? |
| 0x0004 | ----------1-- | *Vinku PLL is not locked.* | 3.1.1.1.1 "RF operating voltage VBAT_ASIC?"<br><br>3.1.1.1.3 "Vinku (N7501) regulator voltages VREG1, VREG2 ok?"<br><br>TX VCO, balun T7503 or loop filter faulty?<br>Check following steps: 3.1.1.1.6 Is there RF power in the TX VCO output at all? And 3.1.1.1.7 "Is TX VCO RF-signal coming to the Vinku at all?", 3.1.3.1 "Is TX VCO frequency as expected?"<br><br>Faulty Vinku (N7501)? |

Please, refer to chapter 2.11 "Error Code Interpretation Examples", if more information about error code interpretation is needed

## 2.6 WCDMA power detector biasing self test (ST_CDSP_PWR_DETECTOR_BIAS_TEST)

This self-test is used to check if the biasing of the WCDMA power detector circuit is ok.

Test covers: Vinku (N7501) WCDMA power detector biasing circuit functionality, Retu (N2200) WTXDET input. RFBUS, VBAT_ASIC

Error code for this self-test is given in format:

- *0xyy, 0xzz, MeasResult1, MeasResult2*



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,where 0xyy, 0xzz part is the main part of the error code: 0xyyzz

| Error code | Bit mask | Reason | Actions |
|---|---|---|---|
| 0x0001 | ----------1 | *Test cannot be executed.* | Internal SW error. Should not happen.<br><br>Does RF-BB interface self test also fail? 3.1.1.1.2 "RFBUS signals ok?" |
| 0x0002 | ----------1- | | |
| 0x0008 | ----------1--- | | |
| 0x0010 | ----------1---- | | |
| 0x0004 | ----------1-- | *Power detector reading is outside limits.* | 3.1.1.1.1. "RF operating voltage VBAT_ASIC?"<br><br>Check WCDMA power detector circuitry: Follow troubleshooting in section 4.1.2.3.2.4 "Does SMPS get correct control voltage from the WCDMA power detector (signal Vcontrol)?"<br><br>Measure also WTXDET-signal: 2.6.1. "WCDMA power detector ok?"<br><br>If ok => Retu AD converter faulty? |

Please, refer to chapter 2.11 "Error Code Interpretation Examples", if more information about error code interpretation is needed.

### 2.6.1 WCDMA power detector ok?

Follow these instructions if it's needed to check WCDMA power detector functionality. Please notice that WCDMA power detector is used only in maximum TX power limiting and WCDMA PA supply voltage controlling purposes.

- WCDMA transmitter has to be active before measurements. Procedure is explained in chapter "General instructions for TX troubleshooting".
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to R7531.
- WTXDET signal should be constant DC-voltage. Voltage level should change if TX power is changed. Vcontrol is lower on lower power levels and higher if higher power levels are used.



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- WTXDET should be about 325 mV with power level +10 dBm, about 1.03 V with power level +21 dBm and about 150 mV when power levels below 0 dBm are used.
- **NOTICE: Perform WCDMA transmitter tests with > 0 dBm power only in RF shielded environment.**
- If WTXDET –signal is not as expected follow the same troubleshooting instructions as in: 4.1.2.3.2.4 "Does SMPS get correct control voltage from the WCDMA power detector (signal Vcontrol)?"

## 2.7 WCDMA transmitter self test (ST_CDSP_WCDMA_TX_POWER_TEST)

This test transmits one WCDMA slot with full TX power and measures the output power with power detector. This information is used to judge if WCDMA TX parts are faulty.

**The phone must be in a shield box, when this test is run to prevent network interference!**

Test covers: Modulator, Vinku (N7501) IC gain stages, IC output supply components, TX filter, WCDMA PA (N7503), DCDC-converter (N7504), RFBUS, VBAT_ASIC, VBAT_PA

Test does not cover: Circulator (Z7505), duplexer (Z7502), antenna

Error code for this self-test is given in format:

- *0xyy, 0xzz, MeasResult1, MeasResult2*

,where 0xyy, 0xzz part is the main part of the error code: 0xyyzz

| Error code | Bit mask | Reason | Actions |
|---|---|---|---|
| 0x0001 | ----------1 | *Test execution failed.* | Internal SW error. Should not happen.<br><br>Does RF-BB interface self test also fail? 3.1.1.1.2 "RFBUS signals ok?" |
| 0x0002 | ----------1- | | |
| 0x0004 | ----------1-- | | |
| 0x0008 | ----------1--- | | |
| 0x0010 | ----------1---- | *Measured output power too low.* | Something is faulty in the WCDMA TX chain (Power detector, Vinku, WCDMA PA, DCDC-converter...).<br><br>Check TX chain manually: 4.1. "WCDMA TX power and transmit frequency ok?" |

Please, refer to chapter 2.11 "Error Code Interpretation Examples", if more information about error code interpretation is needed.



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### *2.8* GSM transmitter self test (ST_CDSP_GSM_TX_POWER_TEST)

This test verifies if GSM transmitter can transmit power.

Test covers: RFIC Vinku (N7501), modulator, IC gain control stages, filter/balun solder joints, GSM PA (N7502), PA bias lines & DACs, RFBUS, TX power detector functionality, VBAT_ASIC, VBAT_PA.

Test does not cover: Antenna functionality, RX/TX-switch functionality, TX signal quality

Error code for this self-test is given in format:

- *0xyy, 0xzz, MeasResult1, MeasResult2, ...*

,where 0xyy, 0xzz part is the main part of the error code: 0xyyzz

| Error code | Bit mask | Reason | Actions |
|---|---|---|---|
| 0x0001 | ----------1 | *GSM900 Tx power is under threshold.* | Check following steps: 3.1 "GSM transmitter power levels and transmit frequency ok?" |
| 0x0002 | ----------1- | *GSM1800 Tx power is under threshold.* | |
| 0x0004 | ----------1-- | *GSM1900 Tx power is under threshold.* | |

Please, refer to chapter 2.11 "Error Code Interpretation Examples", if more information about error code interpretation is needed.

### 2.9 Supply test for Hinku and Vinku (ST_CDSP_RF_SUPPLY_TEST)

This self test tests supply voltage connections of RF ASICs Vinku (N7501) and Hinku (N7500).

The signals supported to be measured are:

- Reference voltage supply to each ASIC
- Regulator connections of each ASICs
- Supply voltage routings to each functional block of each ASIC.

Error code for this self-test is given in format:

- *0xyy, 0xyy, 0xzz, 0xzz, MeasResult1, MeasResult2, ...*

,where 0xyy, 0xyy part is the main part of the error code for Vinku TX ASIC: 0xyyyy

and 0xzz, 0xzz is the main part of the error code for Hinku TX ASIC: 0xzzzz



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NOTICE: There are **two** error code tables for this self-test, one for Vinku and one for Hinku supply voltage troubleshooting.

### Error code table for Vinku supply voltage errors (0xyyyy):

| Error code | Bit mask | Reason | Actions |
|---|---|---|---|
| 0x0001 | ----------1 | *VB_EXT line (RX ASIC Hinku, TX ASIC Vinku or RETU) or TX_MUXOUT line (Vinku or RETU)* | 3.1.1.1.3.1 "Vinku (N7501) RB_EXT voltage ok?"<br>Poor soldering in Vinku ASIC (N7501)? |
| 0x0002 | ----------1- | *VXO supply (RX ASIC Hinku, TX ASIC Vinku, RETU or VCTCXO G7501)* | 3.1.3.3.1 "VXO-voltage ok? (=Vdig)"<br>Poor soldering in Vinku ASIC (N7501)? |
| 0x0004 | ----------1-- | *VBAT1 or VR1 pins of Vinku TX ASIC or Vinku internal regulator(1)* | 3.1.1.1.1 "RF operating voltage VBAT_ASIC?"<br>3.1.1.1.3 "Vinku (N7501) regulator voltages VREG1, VREG2 ok?"<br><br>Poor soldering in Vinku ASIC (N7501)? |
| 0x0008 | ----------1--- | *VBAT2 or VR2 pins of Vinku TX ASIC or Vinku internal regulator(2)* | 3.1.1.1.1 "RF operating voltage VBAT_ASIC?"<br>3.1.1.1.3 "Vinku (N7501) regulator voltages VREG1, VREG2 ok?"<br><br>Poor soldering in Vinku ASIC (N7501)? |
| 0x0010 | ----------1---- | *VRFTX pin of TX ASIC* | 3.1.1.1.1 "RF operating voltage VBAT_ASIC?"<br>3.1.1.1.3 "Vinku (N7501) regulator voltages VREG1, VREG2 ok?"<br><br>Poor soldering in Vinku ASIC (N7501)? |
| 0x0020 | ----------1----- | *VVGA pin of TX ASIC* | 3.1.1.1.1 "RF operating voltage VBAT_ASIC?"<br>3.1.1.1.3 "Vinku (N7501) regulator voltages VREG1, VREG2 ok?"<br><br>Poor soldering in Vinku ASIC (N7501)? |
| 0x0040 | ----------1------ | *VVCO pin of TX ASIC* | Poor soldering in Vinku ASIC (N7501)? |
| 0x0080 | ----------1------- | *VLO pin of TX ASIC* | 3.1.1.1.1 "RF operating voltage VBAT_ASIC?"<br>3.1.1.1.3 "Vinku (N7501) regulator voltages VREG1, VREG2 ok?"<br><br>Poor soldering in Vinku ASIC (N7501)? |



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| | | | |
|---|---|---|---|
| 0x0100 | -------1-------- | *VPRE pin of TX ASIC* | 3.1.1.1.1 "RF operating voltage VBAT_ASIC?"<br>3.1.1.1.3 "Vinku (N7501) regulator voltages VREG1, VREG2 ok?"<br><br>Poor soldering in Vinku ASIC (N7501)? |
| 0x0200 | ------1--------- | *RB_EXT pin of TX ASIC or Vinku internal bias block* | 3.1.1.1.1 "RF operating voltage VBAT_ASIC?"<br>3.1.1.1.3.1 "Vinku (N7501) RB_EXT voltage ok?"<br><br>Poor soldering in Vinku ASIC (N7501)? |
| 0x0800 | ----1---------- | *Temperature sensor* | 3.1.1.1.1 "RF operating voltage VBAT_ASIC?"<br>3.1.1.1.3 "Vinku (N7501) regulator voltages VREG1, VREG2 ok?"<br><br>Faulty Vinku ASIC (N7501) |

**NOTE!** ST_CDSP_RF_SUPPLY_TEST error code: 0x0B, 0xBC, 0x00, 0x00, ... means typically that there is no VBAT_ASIC voltage coming to the Vinku TX ASIC at all or the ASIC is poorly soldered to the PWB (All voltages that are somehow related to VBAT_ASIC are causing errors).

### Error code table for Hinku supply voltage errors (0xzzzz):

| Error code | Bit mask | Reason | Actions |
|---|---|---|---|
| 0x0001 | ----------1 | *VB_EXT pin of Hinku RX ASIC (VB_EXT line tested before with TX ASIC) or CALOUT - CALIN line between RX ASIC and TX ASIC* | If this test didn't failed with Vinku ASIC (N7501) then there has to be poor soldering in Hinku ASIC (N7500).<br><br>Otherwise: 3.2.2.3.1 "Hinku (N7500) RB_EXT voltage ok?" |
| 0x0002 | ----------1- | *VDIG pin of RX ASIC (VXO line tested before with TX ASIC)* | If VXO supply test with Vinku TX ASIC (N7501) has not been failed => Poor soldering in Hinku ASIC (N7500).<br><br>Otherwise: 3.1.3.3.1 "VXO-voltage ok? (=Vdig)" |
| 0x0004 | ----------1-- | *VBAT1 or VR1 pins of Hinku RX ASIC or Hinku internal regulator(1)* | 3.1.1.1.1 "RF operating voltage VBAT_ASIC?"<br><br>If supply test with Vinku TX ASIC (N7501) has not been failed => Poor |



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| | | | |
|---|---|---|---|
| | | | soldering in Hinku RX ASIC (N7500) or faulty Hinku ASIC:<br>3.2.2.3 "Hinku (N7500) regulator voltage VR1 ok?" |
| 0x0008 | ----------1--- | *VMIX pin of Hinku RX ASIC* | 3.1.1.1.1 "RF operating voltage VBAT_ASIC?"<br>3.2.2.3 "Hinku (N7500) regulator voltage VR1 ok?"<br><br>Poor soldering in Hinku ASIC (N7500)? |
| 0x0010 | ----------1---- | *VDDLNA1 & VDDLNA2 pin of Hinku RX ASIC* | 3.1.1.1.1 "RF operating voltage VBAT_ASIC?"<br>3.2.2.3 "Hinku (N7500) regulator voltage VR1 ok?"<br><br>Poor soldering in Hinku ASIC (N7500)? |
| 0x0020 | ----------1----- | *VDDLNA2 pin of Hinku RX ASIC* | 3.1.1.1.1 "RF operating voltage VBAT_ASIC?"<br>3.2.2.3 "Hinku (N7500) regulator voltage VR1 ok?"<br>Poor soldering in Hinku ASIC (N7500)? |
| 0x0040 | ---------1------ | *VLO pin of Hinku RX ASIC* | 3.1.1.1.1 "RF operating voltage VBAT_ASIC?"<br>3.2.2.3 "Hinku (N7500) regulator voltage VR1 ok?"<br><br>Poor soldering in Hinku ASIC (N7500)? |
| 0x0080 | --------1------- | *VPRE pin of Hinku RX ASIC* | 3.1.1.1.1 "RF operating voltage VBAT_ASIC?"<br>3.2.2.3 "Hinku (N7500) regulator voltage VR1 ok?"<br><br>Poor soldering in Hinku ASIC (N7500)? |
| 0x0100 | -------1-------- | *RB_EXT pin of Hinku RX ASIC or Hinku internal bias block* | 3.1.1.1.1 "RF operating voltage VBAT_ASIC?"<br><br>3.2.2.3.1 "Hinku (N7500) RB_EXT voltage ok?" |
| 0x0200 | ------1--------- | *Temperature sensor* | 3.1.1.1.1 "RF operating voltage VBAT_ASIC?"<br>3.2.2.3 "Hinku (N7500) regulator voltage VR1 ok?"<br><br>Faulty Hinku ASIC (N7500) |



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**NOTE!** ST_CDSP_RF_SUPPLY_TEST error code: 0x00, 0x00, 0x03, 0xBF, ... means typically that there is no VBAT_ASIC voltage coming to the Hinku RX ASIC at all or the ASIC is poorly soldered to the PWB (All voltages that are somehow related to VBAT_ASIC are causing errors).

Please, refer to chapter 2.11 "Error Code Interpretation Examples", if more information about error code interpretation is needed.

## 2.10 TXC Data test (ST_TXC_DATA_TEST)

This self-test is used to check if the TXC-signal is coming correctly from Retu (N2200) to Vinku (N7501).

Test covers: TxC power control signal, Retu (N2200), RFBUS, Vinku (N7501), VBAT_ASIC

Error code for this self-test is given in format:

- *0xyy, 0xzz, MeasResult1, MeasResult2, ...*

,where 0xyy, 0xzz part is the main part of the error code: 0xyyzz

| Error code | Bit mask | Reason | Actions |
|---|---|---|---|
| 0x0001 | ----------1 | *TxC voltage too high with minimum input.* | Retu (or Vinku) faulty...Replace the component. |
| 0x0002 | ----------1- | *TxC voltage too low with maximum input.* | 3.1.1.1.1 "RF operating voltage VBAT_ASIC?"<br>3.1.1.1.3 "Vinku (N7501) regulator voltages VREG1, VREG2 ok?"<br><br>Check following step:<br>3.1.1.1.9 "Is there TXC-signal coming to Vinku ASIC (N7501)?" |

Please, refer to chapter 2.11 "Error Code Interpretation Examples", if more information about error code interpretation is needed.

## 2.11 Error Code Interpretation Examples

This chapter presents three different examples of RF error code interpretation.

### 2.11.1 Example 1

ST_CDSP_RX_PLL_PHASE_LOCK self test gives "Fatal" result with error code: 0x00, 0x04

This means that the total error code is 0x004 and if we look an error code table in Chapter 2.1 "RX PLL phase lock self test" the meaning for the code is "*Hinku PLL is not locked*".



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There is also another way to do the error code interpretation in this case:

0x004 hexadecimal value is "100" in binary format. If we look the error code table (bit mask column) again it can be seen that the results is the same *"Hinku PLL is not locked"*.

### 2.11.2 Example 2

Some of the self-tests can return multiple errors at the same time.

For example: ST_CDSP_TX_IQ_TEST self test gives "Fatal" result with error code: 0x00, 0x0F, ...

This means that the error code without measurement values is 0x000F *(The format for error code is explained in chapter 2.4 " TX IQ self test")* and this is the same as "1111" in binary format. If we look an error code table (bit mask column) in Chapter 2.4 "TX IQ self test" there are multiple errors found:

Bit mask ----------1: *"TXIP signal level under threshold"*

Bit mask ----------1-: *"TXIN signal level under threshold"*

Bit mask ----------1--: *"TXQP signal level under threshold"*

Bit mask ----------1---: *"TXQN signal level under threshold"*

But there is no error with:

Bit mask ----------1----: *"CBUS read or write access"*

### 2.11.3 Example 3

Supply test for Hinku and Vinku (ST_CDSP_RF_SUPPLY_TEST) is slightly different self-test from others because there are both Vinku and Hinku errors shown in the same error code (*The format for error code is explained in chapter2.9 " Supply test for Hinku and Vinku").*

For example: ST_CDSP_RF_SUPPLY_TEST gives "Fatal" result with error code: 0x0B, 0xBC, 0x00, 0x00, ...

This error code means that there are probably no errors in Hinku RX ASIC supply voltages because the main part of the error code for Hinku is 0x00, 0x00 (=0x0000) and means the same as "no errors".

Anyway, there are many errors with Vinku TX ASIC supply voltages. The main part of the error code for Vinku is 0x0B, 0xBC and that's the same as "101110111100" in binary format. If we look an error code table (bit mask column) in chapter 2.9 "Supply test for Hinku and Vinku" there are multiple errors found:

Bit mask ----------1--: *"ST_TX_VBAT1_OR_VR1_REG1"*

Bit mask ----------1---: *"ST_TX_VBAT2_OR_VR2_OR_REG2"*

Bit mask ----------1----: *"ST_TX_VRFTX"*



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Bit mask ----------1-----: *"ST_TX_VVGA"*

Bit mask --------1-------: *"ST_TX_VLO"*

Bit mask -------1--------: *"ST_TX_VPRE"*

Bit mask ------1---------: *"ST_TX_RBEXT_OR_BIAS"*

Bit mask ----1-----------: *"ST_TX_TEMP_SENSOR"*

But there are no errors with:

Bit mask ---------------1: *"ST_VBEXT_OR_TXMUXOUT"*

Bit mask --------------1-: *"ST_VXO_SUPPLY"*

Bit mask ---------1------: *"ST_TX_VVCO"*

Bit mask -----1----------: *"No error defined for this bit mask"*

Typically this kind of error occurs if there is no VBAT_ASIC voltage coming to the Vinku TX ASIC at all or the ASIC is poorly soldered to the PWB (All voltages that are somehow related to VBAT_ASIC are causing errors).



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## 3. DOES THE PHONE REGISTER TO THE NETWORK AND MAKE A CALL (GSM)?

- Test against a GSM communication tester or real GSM network with a proper SIM.

### 3.1 GSM transmitter power levels and transmit frequency ok?

- Attach the phone to the product specific test jig (AD-23) and a spectrum analyser to the RF-coupler. Remember that there are two antenna connectors in the coupler, one for GSM and one for WCDMA. Coupler attenuation should be also taken into account during measurements.
- Set GSM Tx ON. Procedure is explained in chapter “General instructions for TX troubleshooting”.
- Spectrum analyser centre frequency should be set according the used TX channel (See chapter “Frequency mappings”).
- Spectrum analyser RBW = VBW = 1 MHz, Span 0 MHz, sweep time 1 ms. Notice that GSM transmission has pulsed nature and power should be measured during TX burst (triggering needed). Another possibility is to use following settings: RBW = VBW = 1 MHz, Span 200 kHz and sweep time at least 2.5 seconds.
- Test at least the maximum and minimum power levels:

- EGSM900: The maximum power level is “5” (31 – 34 dBm, typ. value +33 dBm)

  The minimum power level is “19” (3 – 7 dBm, typ. value +5 dBm)

- DCS1800: The maximum power level is “0” (28 – 32 dBm, typ. value +30 dBm)

  The minimum power level is “15” (-2 - +2 dBm, typ. value +0 dBm)

- PCS1900: The maximum power level is “0” (28 – 32 dBm, typ. value +30 dBm)

  The minimum power level is “15” (-2 - +2 dBm, typ. value +0 dBm)

- If power is not as expected separate the phone into parts and place to the MJ-26 module jig. Connect the spectrum analyser to the module jig GSM RF connector and measure power levels again (*Notice that there are three antenna connectors in the module jig, one for GSM, one for WCDMA and one for Bluetooth. Make sure that all connections are made to the correct RF-connector*).

- Power levels ok in the module jig: Antenna or antenna connection bad. Replace the antenna

- Power levels still wrong or no TX signal found at all: Continue troubleshooting



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- If TX signal is not found at all use wider span setting and check if the transmitter is transmitting on wrong frequency. If the signal is found to be on wrong frequency or frequency is not stabile, see section 3.1.3. "GSM transmitter frequency correct".

3.1.1 Does GSM TX transmit RF-power at all?

- If TX signal is not found at all use wider span setting and check if the transmitter is transmitting on wrong frequency. If signal is found to be on wrong frequency or frequency is not stabile, see section 3.1.3. "GSM transmitter frequency correct".

3.1.1.1 Is Vinku (N7501) transmitting RF-power at all?

- GSM transmitter has to be active before Vinku's output level can be measured. Procedure is explained in chapter "General instructions for TX troubleshooting".
- Measurements can be done with a spectrum analyser and an RF probe. RBW and VBW = 1 MHz, Span = 0, sweep time 1 ms. Spectrum analyser centre frequency should be set according the used TX channel (see chapter "Frequency mappings"). Notice that GSM transmission has pulsed nature and power should be measured during TX burst (triggering needed). Another possibility is to use following settings: RBW = VBW = 1 MHz, Span 200 kHz and sweep time at least 2.5 seconds.
- EGSM900:

- Connect the RF probe to Z7504 input. The level should be about the same on both input pins. Check output level with at least the maximum (5) and the minimum (19) power levels.
- Maximum power level – Output level should be about -15...-25 dBm
- Minimum power level – Output level should be about -45...-55 dBm

- DCS1800/PCS1900:

- Connect the RF probe to C7577 or C7575. The level should be about the same on both capacitors. Check output level with at least the maximum (0) and the minimum (15) power levels.
- Maximum power level – Output level should be about -25...-35 dBm
- Minimum power level – Output level should be about -55...-65 dBm

- Check if output levels of Vinku are as expected.
- **NOTE! If VINKU output RF-power is totally missing just in one or two GSM-bands, typically this means that Vinku ASIC (N7501) is faulty or the ASIC is badly soldered. For example: VINKU is not transmitting at all in EGSM900-band but TX-power is ok in other GSM-bands. Then it's quite clear that VINKU (N7501) is faulty or badly soldered and the component should be replaced.**



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3.1.1.1.1 RF operating voltage VBAT_ASIC?

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7503 (or C7501, C7541)
- VBAT_ASIC voltage level should be 3.05 – 5.4 V. Typical value is 4.0 V.

3.1.1.1.1.1 Ferrite inductor L7503 ok?

- Check that component is in place and solder joints are ok
- Measure voltage from the both ends of L7503. Is it faulty or is there short circuit in RF end?
- Disconnect the power supply from the phone and use an ohmmeter to check that inductor is conducting DC.

3.1.1.1.2 RFBUS signals ok?

- GSM receiver has to be active before RFBUS signals can be measured. Procedure is explained in chapter "GSM RX chain activation for manual measurements". Also WCDMA/GSM transmitter and WCDMA receiver activation can be used for the measurement but then RFBUS -signals don't necessarily look like in figures mentioned below.
- Measurements can be performed with an oscilloscope and a probe. Check all five RF BUS signals:

- *RFBUSDAT*: Connect the probe to J7504. Typical RFBUSDAT -signal is shown in section 6.5.9.3 "RFBUSDAT (GSM RX)"
- *RFBUSCLK*: Connect the probe to J7505. Typical RFBUSCLK -signal is shown in sections 6.5.9.1 "RFUSCLK (GSM RX)" and 6.5.9.2 "RFBUSCLK and RFBUSENA (GSM RX)"
- *RFBUSENA*: Connect the probe to J7506. Typical RFBUSENA -signal is shown in section 6.5.9.2 "RFBUSCLK and RFBUSENA (GSM RX)"
- *RXRESETX*: Connect the probe to J7515. RXRESETX -signal is a constant 2 V DC-signal after GSM or WCDMA transceiver has been activated the first time after phone boot up. The level of this signal should be about 0 V before transceiver activation.
- *TXRESETX*: Connect the probe to J7517. TXRESETX -signal is a constant 2 V DC-signal after GSM or WCDMA transceiver has been activated the first time after phone boot up. The level of this signal should be about 0 V before transceiver activation.

3.1.1.1.2.1 RAP3G (or Vinku or Hinku) faulty?

- RAP3G (D2800) can not be replaced



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3.1.1.1.3 Vinku (N7501) regulator voltages VREG1, VREG2 ok?

- GSM transmitter has to be active before VREG1 and VREG2 voltages can be measured. Procedure is explained in chapter “General instructions for TX troubleshooting.”
- Measurements can be done with an oscilloscope and a probe.
- VREG1: Connect the probe to C7543
- VREG2: Connect the probe to C7548 (or C7547)
- VREG1 and VREG2 voltage levels should be 2.65 – 2.86 V. Typical value is 2.7 V.

3.1.1.1.3.1 Vinku (N7501) RB_EXT voltage ok?

- GSM transmitter has to be active before Vinku’s RB_EXT voltage can be measured. Procedure is explained in chapter “General instructions for TX troubleshooting”.
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to R7521.
- RB_EXT voltage should be 1.325 – 1.375 V.

3.1.1.1.3.1.1 VREFRF01-voltage ok?

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to R7503.
- VREFRF01 voltage should be 1.325 – 1.375 V. Typical value is 1.35 V.

3.1.1.1.3.1.1.1 Desolder R7503. Is VREFRF01 voltage still wrong?

- Remember to solder a new component to R7503 pads after the measurement.

3.1.1.1.3.1.2 R7521 and R7504 in place and working correctly?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and check R7521 and R7504 resistance values with an ohmmeter.

3.1.1.1.3.1.3 VB_EXT voltage ok?

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7518.
- VB_EXT voltage should be 1.325 – 1.375 V. Typical value is 1.35 V.



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3.1.1.1.3.1.3.1 Is R7503 in place and working correctly?

- Check that the component is in place and solder joints are ok
- Disconnect the power supply from the phone and check R7503 resistance value with an ohmmeter

3.1.1.1.3.1.3.2 Capacitors C7518, C7520 and C7570 working correctly?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that capacitors are not short-circuited. If short-circuit is found replace capacitors mentioned above. If this does not help go to the next step.

3.1.1.1.3.1.3.3 Replace Vinku (N7501) or Hinku (N7500) or both

3.1.1.1.3.1.4 Replace Vinku (N7501)

3.1.1.1.3.2 Are capacitors in Vinku (N7501) regulator lines working correctly?

VREG1: C7543

VREG2: C7547, C7548, C7554, C7555, C7553, C7552, C7558 and C7567

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that regulator lines are not short-circuited to the ground. If short-circuit is found replace capacitors mentioned above. If this does not help go to the next step.

3.1.1.1.3.3 TX VCO (G7502) ok?

3.1.1.1.3.4 Replace Vinku (N7501)

3.1.1.1.4 VXO-voltage ok? (=Vdig).

- Measurement can be done with an oscilloscope and a probe
- Connect the probe to C7560 (or C7526, C7513)
- VXO-voltage should be about 2.5 V

3.1.1.1.5 VCP2-voltage ok?

- GSM transmitter has to be active before VCP2 voltage can be measured. Procedure is explained in chapter “General instructions for TX troubleshooting”.
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C2221 (or C7550).



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- VCP2 voltage should be about 4.75 V.

3.1.1.1.5.1 C7550 and C2221 working correctly?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to find out if the VCP2-line is short-circuited to the ground. If short-circuit is found replace C7550 and C2221. If this does not help go to the next steps.

3.1.1.1.5.2 Retu ok?

3.1.1.1.5.3 Vinku (N7501) ok?

3.1.1.1.6 Is there RF power in the TX VCO output at all?

- GSM transmitter has to be active before TX VCO's output frequency and output level can be measured. Procedure is explained in chapter "General instructions for TX troubleshooting".
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used TX channel (see chapter "Frequency mappings").
- Spectrum analyser RBW and VBW = 1 MHz, Span = 0, sweep time 1 ms. Notice that GSM transmission has pulsed nature and VCO output power should be measured during TX burst (triggering needed). Another possibility is to use following settings: RBW = VBW = 1 MHz, Span 200 kHz and sweep time at least 2.5 seconds.
- Connect the RF probe to the T7503 input. VCO shield has to be removed before measurement. Remember to solder the shield back after the phone repairing. *Quick VCO alive check can be done also without removing the RF shield. The RF probe should be placed as near the TX VCO output as possible (Put the head of the probe carefully inside the VCO can through the holes of the shield). Remember to use low RF Attenuator value in the spectrum analyser with this method.*
- Check if the frequency of the TX VCO is as expected. If the VCO signal is not found try to use wider span setting. The correct VCO frequency can be found in chapter "Frequency mappings". The output level of the VCO should be about -25 dBm during GSM TX burst.

3.1.1.1.6.1 TX VCO operating voltage VREG2 (VR2) ok?

- GSM transmitter has to be active before VREG1 and VREG2 voltages can be measured. Procedure is explained in chapter "General instructions for TX troubleshooting".
- Measurements can be done with an oscilloscope and a probe.
- VREG1: Connect the probe to C7543
- VREG2: Connect the probe to C7548 (or C7547)



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- VREG1 and VREG2 voltage levels should be 2.65 – 2.86 V. Typical value is 2.7 V.

3.1.1.1.6.2 Replace TX VCO (G7502)

3.1.1.1.7 Is TX VCO RF-signal coming to the Vinku at all?

- GSM transmitter has to be active before TX VCO's output level can be measured. Procedure is explained in chapter "General instructions for TX troubleshooting".
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used TX channel (see chapter "Frequency mappings").
- Spectrum analyser RBW and VBW = 1 MHz, Span = 0, sweep time 1 ms. Notice that GSM transmission has pulsed nature and VCO output power should be measured during TX burst (triggering needed). Another possibility is to use following settings: RBW = VBW = 1 MHz, Span 200 kHz and sweep time at least 2.5 seconds.
- Check the level of the TX VCO frequency in T7503 outputs. The level should be about -30...-35 dBm in both output lines. If the signal level is correct in the input (about -25 dBm) but output level is not as expected then replace T7503. VCO shield has to be removed before measurement. Remember to solder the shield back after the phone repairing.

3.1.1.1.7.1 Replace balun T7503

3.1.1.1.8 Are TX-IQ signals ok?

- These current mode signals are not possible to measure, but are tested with self-tests. So if there is no fail in 2.4. "ST_CDSP_TX_IQ_TEST" these signals should be ok. Otherwise Vinku (N7501) or RAP3G (D2800) is faulty. Notice that it is not possible to replace RAP3G ASIC.

3.1.1.1.9 Is there TXC-signal coming to Vinku ASIC (N7501)?

- GSM transmitter has to be active before TX control voltage TXC can be measured. Procedure is explained in chapter "General instructions for TX troubleshooting".
- Set TX power level first to the maximum ("5" in EGSM900 and "0" in DCS1800/PCS1900)
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7549
- Typical TX control voltage TXC timing should look somehow similar to figure 6.5.2 (EGSM900 TX power level 5) and voltage levels should be roughly:

- EGSM900: 1.8 V while TX burst and 0 V otherwise.
- DCS1800/PCS1900: 1.8 V while TX burst and 0 V otherwise.

- Change the TX to the minimum power level ("19" in EGSM and "15" in DCS1800/PCS1900)



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- Typical TX control voltage TXC levels should be now about:

- EGSM900: 1.0 V while TX burst and 0 V otherwise.

- DCS1800/PCS1900: 0.7 V while TX burst and 0 V otherwise.

3.1.1.1.9.1 R7514 in place?

- Check that the component is in place and solder joints are ok
- Disconnect the power supply from the phone and check R7514 resistance value with an ohmmeter

3.1.1.1.9.2 C7549 working correctly?

- Check that the component is in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that C7549is not short-circuited. If short-circuit is found replace the capacitor.

3.1.1.1.9.3 Retu ok?

3.1.1.1.10 VCTCXO frequency and output level correct?

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7529 (or C7582)
- The frequency of the VCTCXO should be quite exactly 38.4 MHz and level about 0.5 - 0.9 Vpp. Example of the correct VCTCXO output signal is presented in figure 6.5.1. "VCTCXO Output (DC Offset 1.24 V)"..

3.1.1.1.10.1 VXO-voltage ok? (=Vdig).

- Measurement can be done with an oscilloscope and a probe
- Connect the probe to C7560 (or C7526, C7513)
- VXO-voltage should be about 2.5 V

3.1.1.1.10.2 BB AFC-voltage ok?

- Measurement can be done with an oscilloscope and a probe
- Connect the probe to R7509 (or C7533)
- AFC-voltage may vary between 0.1 - 2.3 V. Typical value is 1.2 V. Phoenix “RF Controls” tool can be used to change the AFC value. Voltage level should be about 0.1 V with AFC value -1024 and about 2.3 V with AFC value 1023.



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3.1.1.1.10.3 Replace VCTCXO G7501

3.1.1.1.11 Replace Vinku (N7501)

3.1.1.2 Is there RF-power in the GSM PA (N7502) input at all?

- GSM transmitter has to be active before measurements. Procedure is explained in chapter "General instructions for TX troubleshooting".
- Set TX power level to the maximum ("5" in EGSM900 and "0" in DCS1800/PCS1900)
- Measurements can be done with a spectrum analyser and an RF probe. Remember to make correct frequency settings to the spectrum analyser. Spectrum analyser centre frequency should be set according the used TX channel (see chapter "Frequency mappings").
- Spectrum analyser RBW and VBW = 1 MHz, Span = 0, sweep time 1 ms. Notice that GSM transmission has pulsed nature and power should be measured during TX burst (triggering needed). Another possibility is to use following settings: RBW = VBW = 1 MHz, Span 200 kHz and sweep time at least 2.5 seconds.
- EGSM900: Connect the probe to J7521 (test point). The RF level should be roughly -15...-20 dBm.
- DCS1800 or PCS1900: Connect the probe to R7512 output. The RF level should be roughly -20...-30 dBm.

3.1.1.2.1 EGSM900: Replace SAW Z7504

3.1.1.2.2 DCS1800/PCS1900: Is Vinku (N7501) output RF-signal coming to the T7502 (Balun)?

- GSM transmitter has to be active before measurements. Procedure is explained in chapter "General instructions for TX troubleshooting". Set TX power level to the maximum ("0" in DCS1800/PCS1900)
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used TX channel (see chapter "Frequency mappings").
- Spectrum analyser RBW and VBW = 1 MHz, Span = 0, sweep time 1 ms. Notice that GSM transmission has pulsed nature and power should be measured during TX burst (triggering needed). Another possibility is to use following settings: RBW = VBW = 1 MHz, Span 200 kHz and sweep time at least 2.5 seconds.
- DCS1800 or PCS1900: Connect the probe to T7502 input. There are two input ports in T7502 because the input port is balanced. The RF level should be roughly -25 dBm in both inputs.



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3.1.1.2.2.1 Matching components ok?

DCS1800/PCS1900: C7575 and C7577

- Check that components are in place and solder joints are ok
- DCS1800 and PCS1900: Disconnect the power supply from the phone and use an ohmmeter to check that capacitors C7575 and C7577 are not short-circuited. If short-circuit is found replace the faulty capacitor.

3.1.1.2.3 DCS1800/PCS1900: Is there RF power in the balun (T7502) output at all?

- GSM transmitter has to be active before measurements. Procedure is explained in chapter "General instructions for TX troubleshooting". Set TX power level to the maximum ("0" in DCS1800/PCS1900)
- Measurements can be done with a spectrum analyser and an RF probe. Remember to make correct frequency settings to the spectrum analyser. Spectrum analyser centre frequency should be set according the used TX channel (see chapter "Frequency mappings").
- Spectrum analyser RBW and VBW = 1 MHz, Span = 0, sweep time 1 ms. Notice that GSM transmission has pulsed nature and power should be measured during TX burst (triggering needed). Another possibility is to use following settings: RBW = VBW = 1 MHz, Span 200 kHz and sweep time at least 2.5 seconds.
- DCS1800 or PCS1900: Connect the probe to R7512 input. The RF level should be roughly -20...-30 dBm.

3.1.1.2.3.1 Replace balun T7502

3.1.1.2.4 DCS1800/PCS1900: Replace attenuator R7512

3.1.1.3 Does GSM PA (N7502) transmit RF-power at all?

- GSM transmitter has to be active before measurements. Procedure is explained in chapter "General instructions for TX troubleshooting".
- Set TX power level to the **minimum** ("19" in EGSM900 and "15" in DCS1800/PCS1900)
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used TX channel (see chapter "Frequency mappings").
- Spectrum analyser RBW and VBW = 1 MHz, Span = 0, sweep time 1 ms. Notice that GSM transmission has pulsed nature and power should be measured during TX burst (triggering needed). Another possibility is to use following settings: RBW = VBW = 1 MHz, Span 200 kHz and sweep time at least 2.5 seconds.



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- EGSM900: Connect the probe to J7520 (test point). The RF level should be about -16...-17 dBm.
- DCS1800 or PCS1900: Connect the probe to J7519 (test point). The RF level should be roughly -29...-30 dBm in both bands.

3.1.1.3.1 GSM PA (N7502) operating voltage ok?

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7593
- Voltage level should be 3.05 – 5.4 V. Typical value is 4.0 V

3.1.1.3.1.1 PA operating voltage VBAT_PA ok?

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7569 (or C7564, C7583)
- Voltage level should be 3.05 – 5.4 V. Typical value is 4.0 V.

3.1.1.3.1.1.1 Ferrite Z7500 ok?

- Check that component is in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that inductor is conducting DC.

3.1.1.3.1.2 C7593 ok?

- Check that the component is in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that the capacitor is not short-circuited. If short-circuit is found replace the capacitor.

3.1.1.3.1.3 Replace inductor L7516

- If replacing doesn't help then replace GSM PA (N7502)

3.1.1.3.2 Are bias currents coming correctly to the GSM PA (N7502)?

EGSM: Icont_21 and Icont_22
DCS1800/PCS1900: Icont_31 and Icont_32

- GSM transmitter has to be active before measurements. Procedure is explained in chapter "General instructions for TX troubleshooting".
- Set TX power level to the maximum ("5" in EGSM900 and "0" in DCS1800/PCS1900)



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- Measurements can be done with an oscilloscope and a VOLTAGE probe.
- EGSM900:

- Connect the probe to C7545 or C7544. Notice: C7544 is a non-assembled component so the probe should be connected to the pad that can be still found from the PWB.
- Typical full TX power bias currents (Icont_21 and Icont_22) should look somehow similar to figure 6.5.4 when measured with an oscilloscope and a probe. Check both currents.

- DCS1800 or PCS1900:

- Connect the probe to C7561 or C7556. Notice: C7556 is a non-assembled component so the probe should be connected to the pad that can be still found from the PWB.
- Typical full TX power bias currents (Icont_31 and Icont_32) should look somehow similar to figure 6.5.5 when measured with an oscilloscope and a probe. Check both currents.

3.1.1.3.2.1 Vinku (N7501) RB_EXT voltage ok?

- GSM transmitter has to be active before Vinku's RB_EXT voltage can be measured. Procedure is explained in section "General instructions for TX troubleshooting".
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to R7521.
- RB_EXT voltage should be 1.325 – 1.375 V.

3.1.1.3.2.2 Are capacitors in GSM PA (N7502) bias lines working correctly?

EGSM: Icont_21 missing – Replace Vinku
Icont_22 missing – C7545 short-circuited?
DCS1800/PCS1900: Icont_31 missing – C7556 short-circuited?
Icont_32 missing – C7561 short-circuited?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that capacitors are not short-circuited. If short-circuit is found replace capacitors mentioned above. If this does not help go to the next step.

3.1.1.3.2.3 Replace Vinku (N7501)

3.1.1.3.3 Replace PA (N7502)

3.1.1.4 Are control voltages VC1, VC2 and VC3 coming correctly to the antenna switch (Z7503)?

- Use "RF Controls" window in Phoenix test software to activate the GSM transmitter and to select the wanted GSM band. Procedure is explained in chapter "General instructions for TX



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troubleshooting". GSM RX activation is described in chapter "GSM RX chain activation for manual measurements".

- Use an oscilloscope and probe to find out if antenna switch control lines are working according to table shown below. "Hi" means that there is 2.4 – 2.8 V control voltage level in the corresponding control line. "Lo" means levels 0 – 0.2 V. Remember to trigger the oscilloscope because control voltages VC1, VC2 and VC3 are pulsed

- Connect the probe to correct test points to measure VC1, VC2 and VC3 voltages (check test point locations from chapter "Test point locations"). Notice: these test points are PWB pads for three non-assembled capacitors.

| Switch mode | Vc1 | Vc2 | Vc3 |
|---|---|---|---|
| EGSM_RX | Lo | Lo | Lo |
| DCS_RX | Lo | Lo | Lo |
| PCS_RX | Lo | Lo | Hi |
| EGSM_TX | Hi | Lo | Lo |
| DCS/PCS_TX | Lo | Hi | Hi |

3.1.1.4.1 Replace Hinku (N7500)

3.1.1.5 Replace antenna Switch Z7503

3.1.2 Does GSM TX transmit enough RF-power and power levels otherwise ok?

3.1.2.1 Is Vinku ASIC (N7501) transmitting correct RF-power?

- GSM transmitter has to be active before Vinku's output level can be measured. Procedure is explained in chapter "General instructions for TX troubleshooting".

- Measurements can be done with a spectrum analyser and an RF probe. RBW and VBW = 1 MHz, Span = 0, sweep time 1 ms. Spectrum analyser centre frequency should be set according the used TX channel (see chapter "Frequency mappings"). Notice that GSM transmission has pulsed nature and power should be measured during TX burst (triggering needed). Another possibility is to use following settings: RBW = VBW = 1 MHz, Span 200 kHz and sweep time at least 2.5 seconds.

- EGSM900:

- Connect the RF probe to Z7504 input. The level should be about the same on both input pins. Check output level with at least the maximum (5) and the minimum (19) power levels.

- Maximum power level – Output level should be about -15...-25 dBm

- Minimum power level – Output level should be about -45...-55 dBm



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- DCS1800/PCS1900:

- Connect the RF probe to C7577 or C7575. The level should be about the same on both capacitors. Check output level with at least the maximum (0) and the minimum (15) power levels.

- Maximum power level – Output level should be about -25...-35 dBm

- Minimum power level – Output level should be about -55...-65 dBm

- Check if output levels of Vinku are as expected.

- **NOTE! If VINKU ASIC is transmitting wrong TX power just in one or two GSM-bands, typically this means that Vinku ASIC (N7501) is faulty or the ASIC is badly soldered. Of course SAW-filter Z7504 or balun T7502 can be also faulty/badly soldered and causing shortcircuit, but probability to this is quite low. For example: VINKU is transmitting too low power in EGSM900-band but TX-power is ok in other GSM-bands. Then it's almost clear that VINKU (N7501) is faulty or badly soldered and the component should be replaced.**

3.1.2.1.1 RF operating voltage VBAT_ASIC ok?

- Measurement can be done with an oscilloscope and a probe.

- Connect the probe to C7503 (or C7501, C7541)

- VBAT_ASIC voltage level should be 3.05 – 5.4 V. Typical value is 4.0 V.

3.1.2.1.2 Are Vinku (N7501) regulator voltages VREG1, VREG2 ok?

- GSM transmitter has to be active before VREG1 and VREG2 voltages can be measured. Procedure is explained in section "General instructions for TX troubleshooting".

- Measurements can be done with an oscilloscope and a probe.

- VREG1: Connect the probe to C7543

- VREG2: Connect the probe to C7548 (or C7547)

- VREG1 and VREG2 voltage levels should be 2.65 – 2.86 V. Typical value is 2.7 V.

3.1.2.1.3 Are TX-IQ signal waveforms looking correct?

- These current mode signals are not possible to measure, but are tested with self-tests. So if there is no fail in 2.4 ST_CDSP_TX_IQ_TEST these signals should be ok. Otherwise Vinku (N7501) or RAP3G (D2800) is faulty. Notice that it is not possible to replace RAP3G ASIC.



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3.1.2.1.4 Is the TXC-signal coming to Vinku ASIC (N7501) OK? Is signal level correct?

- GSM transmitter has to be active before TX control voltage TXC can be measured. Procedure is explained in section “General instructions for TX troubleshooting”.
- Set TX power level first to the maximum (“5” in EGSM900 and “0” in DCS1800/PCS1900)
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7549
- Typical TX control voltage TXC timing should look somehow similar to figure 6.5.2 “TXC in GSM mode (DC offset 0 V)” (EGSM900 TX power level 5) and voltage levels should be roughly:

- EGSM900: 1.8 V while TX burst and 0 V otherwise.
- DCS1800/PCS1900: 1.8 V while TX burst and 0 V otherwise.

- Change the TX to the minimum power level (“19” in EGSM and “15” in DCS1800/PCS1900)
- Typical TX control voltage TXC levels should be now about:

- EGSM900: 1.0 V while TX burst and 0 V otherwise.
- DCS1800/PCS1900: 0.7 V while TX burst and 0 V otherwise.

3.1.2.1.4.1 R7514 in place and working correctly?

- Check that the component is in place and solder joints are ok
- Disconnect the power supply from the phone and check R514 resistance value with an ohmmeter

3.1.2.1.4.2 C7549 working correctly?

- Check that the component is in place and solder joints are ok
- Disconnect the power supply from the phone and check with an ohmmeter that C7549 is not short-circuited.

3.1.2.1.4.3 Retu ok?

3.1.2.1.5 Does GSM PA (N7502) get correct DET_SW_G -voltage from Vinku ASIC (N7501)?

- GSM transmitter has to be active before DET_SW_G voltage can be measured. Procedure is explained in chapter “General instructions for TX troubleshooting”.
- Measurement can be done with an oscilloscope and a probe.



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- Connect the probe to C7595 pad. Notice: C7595 is a non-assembled component so the probe should be connected to the pad that can be still found from the PWB.
- DET_SW_G voltage should be about 2.8 V while TX burst and 0 V otherwise.

3.1.2.1.5.1 C7595 working correctly?

- Check that the component is in place and solder joints are ok
- Disconnect the power supply from the phone and check with an ohmmeter that C7595 is not short-circuited.

3.1.2.1.5.2 Replace Vinku (N7501)

3.1.2.1.6 Are components in GSM power control loop in place and working ok?

R7516 and C7559

- Disconnect the power supply from the phone and use an ohmmeter to check that C7559 is not short-circuited. If short-circuit is found replace the capacitor.
- Check R7516 resistance value with an ohmmeter and replace resistor if needed.

3.1.2.1.7 Is TX VCO signal level in the T7503 output high enough?

- GSM transmitter has to be active before TX VCO's output level can be measured. Procedure is explained in chapter "General instructions for TX troubleshooting".
- Measurements can be done with a spectrum analyser and an RF probe. RBW and VBW = 1 MHz, Span = 0, sweep time 1 ms. Spectrum analyser centre frequency should be set according the used TX channel (see chapter "Frequency mappings"). Notice that GSM transmission has pulsed nature and VCO output power should be measured during TX burst (triggering needed). Another possibility is to use following settings: RBW = VBW = 1 MHz, Span 200 kHz and sweep time at least 2.5 seconds.
- Check the level of the VCO frequency in T7503 outputs. The level should be about -30...-35 dBm in both output lines during GSM TX burst. If the signal level is correct in the input (about -25 dBm) but output level is not as expected then replace T7503. VCO shield has to be removed before measurement. Remember to solder the shield back after the phone repairing.

3.1.2.1.7.1 TX VCO G7502 output level high enough?

- GSM transmitter has to be active before TX VCO's output frequency and output level can be measured. Procedure is explained in chapter "General instructions for TX troubleshooting".
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used TX channel (see chapter "Frequency mappings").



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- Spectrum analyser RBW and VBW = 1 MHz, Span = 0, sweep time 1 ms. Notice that GSM transmission has pulsed nature and VCO output power should be measured during TX burst (triggering needed). Another possibility is to use following settings: RBW = VBW = 1 MHz, Span 200 kHz and sweep time at least 2.5 seconds.
- Connect the RF probe to the T7503 input. VCO shield has to be removed before measurement. Remember to solder the shield back after the phone repairing.
- Check if the frequency of the TX VCO is as expected. If the VCO signal is not found try to use wider span setting. The output level of the VCO should be about -25 dBm during GSM TX burst.

3.1.2.1.7.1.1 Replace TX VCO G7502

3.1.2.1.7.2 Replace balun T7503

3.1.2.1.8 Replace Vinku (N7501) or GSM PA (N7502)

- If the output level of Vinku is higher than wanted then replace GSM PA (N7502). Otherwise replace TX ASIC Vinku (N7501).

3.1.2.2 Does GSM PA (N7502) have enough RF-power in its input?

- GSM transmitter has to be active before measurements. Procedure is explained in chapter “General instructions for TX troubleshooting”.
- Set TX power level to the maximum (“5” in EGSM900 and “0” in DCS1800/PCS1900)
- Measurements can be done with a spectrum analyser and an RF probe. Remember to make correct frequency settings to the spectrum analyser. Spectrum analyser centre frequency should be set according the used TX channel (see chapter “Frequency mappings”).
- Spectrum analyser RBW and VBW = 1 MHz, Span = 0, sweep time 1 ms. Notice that GSM transmission has pulsed nature and power should be measured during TX burst (triggering needed). Another possibility is to use following settings: RBW = VBW = 1 MHz, Span 200 kHz and sweep time at least 2.5 seconds.
- EGSM900: Connect the probe to J7521 (test point). The RF level should be roughly -15...-20 dBm.
- DCS1800 or PCS1900: Connect the probe to R7512 output. The RF level should be roughly -20...-30 dBm.

3.1.2.2.1 EGSM900: Replace SAW Z7504

3.1.2.2.2 DCS1800/PCS1900: Is Vinku (N7501) output RF-signal coming correctly to the T7502 (Balun)?

- GSM transmitter has to be active before measurements Procedure is explained in chapter “General instructions for TX troubleshooting”.



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- Set TX power level to the maximum (“0” in DCS1800/PCS1900)
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used TX channel (see chapter “Frequency mappings”).
- Spectrum analyser RBW and VBW = 1 MHz, Span = 0, sweep time 1 ms. Notice that GSM transmission has pulsed nature and power should be measured during TX burst (triggering needed). Another possibility is to use following settings: RBW = VBW = 1 MHz, Span 200 kHz and sweep time at least 2.5 seconds.
- DCS1800 or PCS1900: Connect the probe to T7502 input. There are two input ports in T7502 because the input port is balanced. The RF level should be roughly -25 dBm in both inputs.

3.1.2.2.2.1 Matching components ok?

DCS1800/PCS1900: C7575 and C7577

- Check that components are in place and solder joints are ok
- DCS1800 and PCS1900: Disconnect the power supply from the phone and use an ohmmeter to check that capacitors C7575 and C7577 are not short-circuited. If short-circuit is found replace the faulty capacitor.

3.1.2.2.3 DCS1800/PCS1900: Is there correct RF power in the balun (T7502) output?

- GSM transmitter has to be active before measurements. Procedure is explained in chapter “General instructions for TX troubleshooting”.
- Set TX power level to the maximum (“0” in DCS1800/PCS1900)
- Measurements can be done with a spectrum analyser and an RF probe. Remember to make correct frequency settings to the spectrum analyser. Spectrum analyser centre frequency should be set according the used TX channel (see chapter “Frequency mappings”).
- Spectrum analyser RBW and VBW = 1 MHz, Span = 0, sweep time 1 ms. Notice that GSM transmission has pulsed nature and power should be measured during TX burst (triggering needed). Another possibility is to use following settings: RBW = VBW = 1 MHz, Span 200 kHz and sweep time at least 2.5 seconds.
- DCS1800 or PCS1900: Connect the probe to R7512 input. The RF level should be roughly -20...-30 dBm.

3.1.2.2.3.1 Replace balun T7502

3.1.2.2.4 DCS1800/PCS1900: Replace attenuator R7512



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3.1.2.3 GSM PA (N7502) transmitting correct RF-power?

- GSM transmitter has to be active before measurements. Procedure is explained in chapter "General instructions for TX troubleshooting".
- Set TX power level to the **minimum** ("19" in EGSM900 and "15" in DCS1800/PCS1900)
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used TX channel (see chapter "Frequency mappings").
- Spectrum analyser RBW and VBW = 1 MHz, Span = 0, sweep time 1 ms. Notice that GSM transmission has pulsed nature and power should be measured during TX burst (triggering needed). Another possibility is to use following settings: RBW = VBW = 1 MHz, Span 200 kHz and sweep time at least 2.5 seconds.
- EGSM900: Connect the probe to J7520 (test point). The RF level should be about -16...-17 dBm.
- DCS1800 or PCS1900: Connect the probe to J7519 (test point). The RF level should be roughly -29...-30 dBm in both bands.

3.1.2.3.1 GSM PA (N7502) operating voltage ok?

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7593
- Voltage level should be 3.05 – 5.4 V. Typical value is 4.0 V.

3.1.2.3.1.1 PA operating voltage VBAT_PA ok?

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7569 (or C7564, C7583)
- Voltage level should be 3.05 – 5.4 V. Typical value is 4.0 V.

3.1.2.3.1.1.1 Ferrite Z7500 ok?

- Check that component is in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that inductor is conducting DC.

3.1.2.3.1.2 C7593 ok?

- Check that the component is in place and solder joints are ok



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- Disconnect the power supply from the phone and use an ohmmeter to check that the capacitor is not short-circuited. If short-circuit is found replace the capacitor.

3.1.2.3.1.3 Replace inductor L7516

- If replacing doesn't help then replace GSM PA (N7502)

3.1.2.3.2 Are bias currents coming correctly to the GSM PA (N7502)? Level ok?

EGSM: Icont_21 and Icont_22
DCS1800/PCS1900: Icont_31 and Icont_32

- GSM transmitter has to be active before measurements. Procedure is explained in chapter "General instructions for TX troubleshooting".
- Set TX power level to the maximum ("5" in EGSM900 and "0" in DCS1800/PCS1900)
- Measurements can be done with an oscilloscope and a VOLTAGE probe.
- EGSM900:

- Connect the probe to C7545 or C7544. Notice: C7544 is a non-assembled component so the probe should be connected to the pad that can be still found from the PWB
- Typical full TX power bias currents (Icont_21 and Icont_22) should look somehow similar to figure 6.5.4 "Icont_21/Icont_22 (DC Offset 1.2 V)" when measured with an oscilloscope and a probe. Check both currents.

- DCS1800 or PCS1900:

- Connect the probe to C7561 or C7556. Notice: C7556 is a non-assembled component so the probe should be connected to the pad that can be still found from the PWB
- Typical full TX power bias currents (Icont_31 and Icont_32) should look somehow similar to figure 6.5.5 "Icont_31/Icont_32 (DC Offset 1.2 V)" when measured with an oscilloscope and a probe. Check both currents.

3.1.2.3.2.1 Vinku (N7501) RB_EXT voltage ok?

- GSM transmitter has to be active before Vinku's RB_EXT voltage can be measured. Procedure is explained in chapter "General instructions for TX troubleshooting".
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to R7521.
- RB_EXT voltage should be 1.325 – 1.375 V.



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3.1.2.3.2.2 Are capacitors in GSM PA (N7502) bias lines working correctly?

EGSM: Icont_21 missing – Replace Vinku
Icont_22 missing – C7545 short-circuited?
DCS1800/PCS1900: Icont_31 missing – C7556 short-circuited?
Icont_32 missing – C7561 short-circuited?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that capacitors are not short-circuited. If short-circuit is found replace capacitors mentioned above.

3.1.2.3.2.3 Replace Vinku (N7501) or GSM PA (N7502)

3.1.2.3.3 Replace GSM PA (N7502)

3.1.2.4 Are control voltages VC1, VC2 and VC3 coming correctly to the antenna switch (Z7503)?

- Use "RF Controls" window in Phoenix test software to activate the GSM transmitter and to select the wanted GSM band. Procedure is explained in chapter "General instructions for TX troubleshooting". GSM RX activation is described in chapter "GSM RX chain activation for manual measurements".
- Use an oscilloscope and probe to find out if antenna switch control lines are working according to table shown below. "Hi" means that there is 2.4 – 2.8 V control voltage level in the corresponding control line. "Lo" means levels 0 – 0.2 V. Remember to trigger the oscilloscope because control voltages VC1, VC2 and VC3 are pulsed
- Connect the probe to correct test points to measure VC1, VC2 and VC3 voltages (check test point locations, see chapter "Test point locations). Notice: these test points are PWB pads for three non-assembled capacitors.

| Switch mode | Vc1 | Vc2 | Vc3 |
|---|---|---|---|
| EGSM_RX | Lo | Lo | Lo |
| DCS_RX | Lo | Lo | Lo |
| PCS_RX | Lo | Lo | Hi |
| EGSM_TX | Hi | Lo | Lo |
| DCS/PCS_TX | Lo | Hi | Hi |

3.1.2.5 Replace antenna switch Z503



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### 3.1.3 GSM transmitter frequency correct?

- Connect a spectrum analyser to the module test jig (MJ-26) RF connector.
- Set GSM Tx ON. Procedure is explained in chapter “General instructions for TX troubleshooting”.
- Check if the frequency of the GSM transmitter is as expected. If output signal is not found try to use 500 MHz span setting.

  The correct TX frequency is shown in Phoenix “RF Controls (GSM)” window and can be found also in chapter “Frequency mappings”. If the frequency is not found at all then go to 3.1.1 “Does GSM TX transmit RF-power at all?”

#### 3.1.3.1 Is TX VCO frequency as expected?

- GSM transmitter has to be active before TX VCO’s output frequency and output level can be measured. Procedure is explained in chapter “General instructions for TX troubleshooting”.
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used TX channel (see chapter “Frequency mappings”).
- Spectrum analyser RBW and VBW = 1 MHz, Span = 0, sweep time 1 ms. Notice that GSM transmission has pulsed nature and VCO output power should be measured during TX burst (triggering needed). Another possibility is to use following settings: RBW = VBW = 1 MHz, Span 200 kHz and sweep time at least 2.5 seconds.
- Connect the RF probe to the T7503 input. VCO shield has to be removed before measurement. Remember to solder the shield back after the phone repairing. *Quick VCO alive check can be done without removing the RF shield. The RF probe should be placed as near the TX VCO output as possible (Put the head of the probe carefully inside the VCO can through the holes of the shield). This method can be used only to check that the TX VCO is alive. It won’t expose if the T7503 is broken or the output level of the VCO is too low. Remember to use low RF Attenuator value in the spectrum analyser with this method.*
- Check if the frequency of the TX VCO is as expected. If the VCO signal is not found try to use wider span setting. The output level of the VCO should be about -25 dBm during GSM TX burst.

##### 3.1.3.1.1 C7543, C7548 and L7517 ok?

- These components should be checked if TX VCO frequency is not stable and TX PLL frequency not locked.
- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that inductor is conducting DC.



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3.1.3.1.2 TX VCO control voltage VC ok?

- GSM transmitter has to be active before TX VCO control voltage VC can be measured. Procedure is explained in chapter “General instructions for TX troubleshooting”.
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to R7519.
- Typical TX VCO control voltage VC should look somehow similar to figure 6.5.3. DC voltage level should change if TX channel is changed. VC is lower on lower channels and higher if higher channel numbers are used.

3.1.3.1.2.1 VCP2-voltage ok?

- GSM transmitter has to be active before VCP2 voltage can be measured. Procedure is explained in chapter “General instructions for TX troubleshooting”.
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C2221 (or C7550).
- VCP2 voltage should be about 4.75 V.

3.1.3.1.2.2 Vinku (N7501) RB_EXT voltage ok?

- GSM transmitter has to be active before Vinku’s RB_EXT voltage can be measured. Procedure is explained in chapter “General instructions for TX troubleshooting”.
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to R7521.
- RB_EXT voltage should be 1.325 – 1.375 V.

3.1.3.1.2.3 Balun T7503 ok?

- GSM transmitter has to be active before TX VCO’s output level can be measured. Procedure is explained in chapter “General instructions for TX troubleshooting”.
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used TX channel (see chapter “Frequency mappings”).
- Spectrum analyser RBW and VBW = 1 MHz, Span = 0, sweep time 1 ms. Notice that GSM transmission has pulsed nature and VCO output power should be measured during TX burst (triggering needed). Another possibility is to use following settings: RBW = VBW = 1 MHz, Span 200 kHz and sweep time at least 2.5 seconds.



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- Check the level of the TX VCO frequency in T7503 outputs. The level should be about -30...-35 dBm in both output lines. If the signal level is correct in the input (about -25 dBm) but output level is not as expected then replace T7503. VCO shield has to be removed before measurement. Remember to solder the shield back after the phone repairing.

3.1.3.1.2.4 Components near TX VCO ok?

C7571, R7519, R7523, C7573 and C7568 working correctly?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and check resistors resistance values with an ohmmeter.
- Use an ohmmeter to check also that capacitors are not short-circuited

3.1.3.1.2.5 Replace Vinku (N7501) or TX VCO (G7502) or both

3.1.3.1.3 Replace TX VCO G7502

3.1.3.2 Is TX VCO signal level in the T7503 output high enough?

- GSM transmitter has to be active before TX VCO's output level can be measured. Procedure is explained in chapter "General instructions for TX troubleshooting".
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used TX channel (see chapter "Frequency mappings").
- Spectrum analyser RBW and VBW = 1 MHz, Span = 0, sweep time 1 ms. Notice that GSM transmission has pulsed nature and VCO output power should be measured during TX burst (triggering needed). Another possibility is to use following settings: RBW = VBW = 1 MHz, Span 200 kHz and sweep time at least 2.5 seconds.
- Check the level of the VCO frequency in T7503 outputs. The level should be about -30...-35 dBm in both output lines during GSM TX burst. If the signal level is correct in the input (about -25 dBm) but output level is not as expected then replace T7503. VCO shield has to be removed before measurement. Remember to solder the shield back after the phone repairing.

3.1.3.2.1 TX VCO G7502 output level high enough?

- GSM transmitter has to be active before TX VCO's output frequency and output level can be measured. Procedure is explained in chapter "General instructions for TX troubleshooting".
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used TX channel (see chapter "Frequency mappings").



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- Spectrum analyser RBW and VBW = 1 MHz, Span = 0, sweep time 1 ms. Notice that GSM transmission has pulsed nature and VCO output power should be measured during TX burst (triggering needed). Another possibility is to use following settings: RBW = VBW = 1 MHz, Span 200 kHz and sweep time at least 2.5 seconds.
- Connect the RF probe to the T7503 input. VCO shield has to be removed before measurement. Remember to solder the shield back after the phone repairing.
- Check if the frequency of the TX VCO is as expected. If the VCO signal is not found try to use wider span setting. The output level of the VCO should be about -25 dBm during GSM TX burst.

3.1.3.2.1.1 Replace TX VCO G7502

3.1.3.2.2 Replace balun T7503

3.1.3.3 VCTCXO frequency and output level ok?

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7529 (or C7582)
- The frequency of the VCTCXO should be quite exactly 38.4 MHz and level about 0.5 - 0.9 Vpp. Example of the correct VCTCXO output signal is presented in figure 6.5.1 "VCTCXO Output (DC Offset 1.24 V)".

3.1.3.3.1 VXO-voltage ok? (=Vdig).

- Measurement can be done with an oscilloscope and a probe
- Connect the probe to C7560 (or C7526, C7513)
- VXO-voltage should be about 2.5 V

3.1.3.3.1.1 C7560, C7513, C7526 and C2214 ok?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to find out if the VXO-line is short-circuited to the ground. If short-circuit is found replace C7560, C7513, C7526 and C2214. If replacing does not help then go to the next steps.

3.1.3.3.1.2 Replace Retu

3.1.3.3.1.3 Replace Hinku (N7500) or Vinku (N7501) or VCTCXO (G7501) or all three components



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3.1.3.3.2 BB AFC-voltage ok?

- Measurement can be done with an oscilloscope and a probe
- Connect the probe to R7509 (or C7533)
- AFC-voltage may vary between 0.1 - 2.3 V. Typical value is 1.2 V. Phoenix “RF Controls” tool can be used to change the AFC value. Voltage level should be about 0.1 V with AFC value -1024 and about 2.3 V with AFC value 1023.

3.1.3.3.2.1 Low pass filter components R7509 and C7533 ok?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and check R7509 resistance value with an ohmmeter.
- Use an ohmmeter to find out also if the AFC-line is short-circuited to the ground. If short-circuit is found replace C7533. If this does not help then go to the next steps.

3.1.3.3.2.2 VCTCXO ok?

- Remove R7509. If AFC-voltage is correct after removing then replace faulty VCTCXO G7501 and solder R7509 (new component) back to the PWB

3.1.3.3.2.3 Replace Retu

3.1.3.3.3 Replace VCTCXO G7501

## 3.2 Does the phone give realistic RSSI-values?

Attach the phone to the product specific test jig (AD-23) and a signal generator to the RF-coupler. Remember that there are two antenna connectors in the coupler, one for GSM and one for WCDMA. Coupler attenuation should be also taken into account during measurements.

Use the signal generator to supply -90 dBm RF-level (unmodulated signal) to the phone via the antenna coupler. Set generator RF-level to -90 dBm + Cable and coupler attenuation. This measurement should be performed in a RF-shielded environment because existing GSM-network base stations can disturb this measurement otherwise.

- Set RF-generator frequency as following:

- EGSM900: 942.46771 MHz (channel 37)
- DCS1800: 1842.86771 MHz (channel 700)
- PCS1900: 1960.06771 MHz (channel 661)



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- Use Phoenix testing & tuning software to perform GSM receiver activation and RSSI measurement for proper channels. Procedure is explained in chapter “GSM RX chain activation for manual measurements” (Start “Testing” -> “GSM” -> “RSSI Reading” tool in Phoenix. Select the correct band and channel).
- “RSSI Reading” -tool should show quite exact -90 dBm RSSI level. Remember to take into account attenuation between the phone and signal generator. Test also Q and I branches separately. Signal level in both I and Q lines should be about -93 dBm
- Increase signal generator RF level to -60 dBm. Phoenix ”RSSI Reading” tool should show now quite exact RSSI level -60 dBm. Test also Q and I branches separately. Signal level in both I and Q lines should be about -63 dBm
- If RSSI-levels are not as expected separate the phone into parts and place to the MJ-26 module jig. Connect the signal generator to the module jig GSM RF connector (*Notice that there are three antenna connectors in the module jig, one for GSM, one for WCDMA and one for Bluetooth. Make sure that all connections are made to the correct RF-connector*).

3.2.1 Is Hinku (N7500) ASIC receiving RF-power correctly from the GSM-antenna connector?

- GSM receiver has to be active before measurements. Procedure is explained in chapter “GSM RX chain activation for manual measurements.”
- Connect an RF-generator to the GSM-antenna connector
- Set RF-generator frequency as following:

- EGSM900: 942.46771 MHz
- DCS1800: 1842.86771 MHz
- PCS1900: 1960.06771 MHz

- Measurements can be done with a spectrum analyser and an RF probe. Remember to make correct frequency settings to the spectrum analyser (Centre frequency should be set to the same frequency as the RF-generator). RBW and VBW = 10 kHz, Span = 0 kHz, sweep time 5 ms.
- RF-signals in this measurement are pulsed and video triggering is needed in the spectrum analyser (software dependent issue. With some phone softwares these signals are constant in “Local” mode and triggering is not needed)
- EGSM900: Connect the probe to C7512 or C7514. The RF level should be roughly -85 dBm during RX period when input signal in GSM antenna connector is -50 dBm. RF-levels should be about the same on both capacitors. Remember to select the correct band also in Phoenix.
- DCS1800: Connect the probe to C7581 or C7584. The RF level should be roughly -85...-90 dBm during RX period when input signal in GSM antenna connector is -50 dBm.



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RF-levels should be about the same on both capacitors. Remember to select the correct band also in Phoenix.

- PCS1900: Connect the probe to C7523 or C7525. The RF level should be roughly -85...-90 dBm during RX period when input signal in GSM antenna connector is -50 dBm. RF-levels should be about the same on both capacitors. Remember to select the correct band also in Phoenix.

- **NOTE! If RSSI-values are correct only in one or two GSM-bands but RX ASIC HINKU (N7500) is receiving RF-power correctly from the GSM antenna connector in all three GSM-bands, typically this means that Hinku ASIC (N7500) is faulty or the ASIC is badly soldered. For example: RSSI-values are not realistic in EGSM900-band but are ok in other bands and HINKU is receiving RF-power correctly in all bands. Then it's quite clear that HINKU (N7500) is faulty or badly soldered and the component should be replaced.**

3.2.1.1 Is Z7503 (antenna switch) working correctly?

- GSM receiver has to be active before measurements. Procedure is explained in chapter "GSM RX chain activation for manual measurements".

- Connect an RF-generator to the GSM-antenna connector

- Set RF-generator frequency as following:

- EGSM900: 942.46771 MHz (Channel 37)

- DCS1800: 1842.86771 MHz (Channel 700)

- PCS1900: 1960.06771 MHz (Channel 661)

- Measurements can be done with a spectrum analyser and an RF probe. Remember to make correct frequency settings to the spectrum analyser (Centre frequency should be set to the same frequency as the RF-generator). RBW and VBW = 10 kHz, Span = 0 kHz, sweep time 5 ms.

- RF-signals in this measurement are pulsed and video triggering is needed in the spectrum analyser (software dependent issue. With some phone softwares these signals are constant in "Local" mode and triggering is not needed).

- EGSM900: Connect the probe to L7504. The RF level should be roughly -75 dBm during RX period when input signal in GSM antenna connector is -50 dBm. RF-levels should be about the same on both ends of the inductor. Remember to select the correct band also in Phoenix.

- DCS1800: Connect the probe to L7505. The RF level should be roughly -85 dBm during RX period when input signal in GSM antenna connector is -50 dBm. RF-levels should be about the same on both ends of the inductor. Remember to select the correct band also in Phoenix.



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- PCS1900: Connect the probe to L7506. The RF level should be roughly -85 dBm during RX period when input signal in GSM antenna connector is -50 dBm. RF-levels should be about the same on both ends of the inductor. Remember to select the correct band also in Phoenix.

3.2.1.1.1 Are control voltages VC1, VC2 and VC3 coming correctly to the antenna switch (Z7503)?

- Use "RF Controls" window in Phoenix test software to activate the GSM transmitter and to select the wanted GSM band. Procedure is explained in chapter "General instructions for TX troubleshooting". GSM RX activation is described in chapter "GSM RX chain activation for manual measurements".
- Use an oscilloscope and probe to find out if antenna switch control lines are working according to table shown below. "Hi" means that there is 2.4 – 2.8 V control voltage level in the corresponding control line. "Lo" means levels 0 – 0.2 V. Remember to trigger the oscilloscope because control voltages VC1, VC2 and VC3 are pulsed

- Connect the probe to correct test points to measure VC1, VC2 and VC3 voltages (check test point locations, see chapter "Test point locations"). Notice: these test points are PWB pads for three non-assembled
capacitors.

| Switch mode | Vc1 | Vc2 | Vc3 |
|---|---|---|---|
| EGSM_RX | Lo | Lo | Lo |
| DCS_RX | Lo | Lo | Lo |
| PCS_RX | Lo | Lo | Hi |
| EGSM_TX | Hi | Lo | Lo |
| DCS/PCS_TX | Lo | Hi | Hi |

3.2.1.1.2 Replace antenna switch Z503

3.2.1.2 Are matching components in place and working correctly?

EGSM900: C7512, C7514 and L7504

DCS1800: C7581, C7584 and L7505

PCS1900: C7523, C7525 and L7506

- Check that components are in place and solder joints are ok
- Use an ohmmeter to check that inductors are conducting DC.
- Replace matching components



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### 3.2.2 Are RX-IQ signal waveforms and levels correct?

- Measurements can be done with an oscilloscope, a probe and signal generator.
- GSM receiver has to be active before RX IQ-signals can be measured. Procedure is explained in chapter “GSM RX chain activation for manual measurements”.
- Apply –70 dBm RF signal from a signal generator to the module jig antenna connector and use following frequencies:
- EGSM900: 942.46771 MHz (Channel 37)
- DCS1800: 1842.86771 MHz (Channel 700)
- PCS1900: 1960.06771 MHz (Channel 661)
- Remember to change correct RX channels also to Phoenix “RF controls” window!
- Check RX I and RX Q -signals in following test points:
- RX I (positive): Connect the probe to test point J7508
- RX I (negative): Connect the probe to test point J7509
- RX Q (positive): Connect the probe to test point J7510
- RX Q (negative): Connect the probe to test point J7511
- The correct RX IQ-signal is shown in figure 6.5.6 "GSM RX IQ (DC Offset 0.4 V)". Level of all four IQ-signals should be about the same and RX IQ-signal frequency should be 67.71 kHz (lower detail figure). The phase shift between I- and Q-signals should be 90 degrees.

#### 3.2.2.1 RF operating voltage VBAT_ASIC ok?

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7503 (or C7501, C7541)
- VBAT_ASIC voltage level should be 3.05 – 5.4 V. Typical value is 4.0 V.

#### 3.2.2.2 RFBUS signals ok?

- GSM receiver has to be active before RFBUS signals can be measured. Procedure is explained in chapter “GSM RX chain activation for manual measurements”. Also WCDMA/GSM transmitter and WCDMA receiver activation can be used for the measurement but then RFBUS -signals don’t necessarily look like in figures mentioned below.
- Measurements can be performed with an oscilloscope and a probe. Check all five RF BUS signals:
- *RFBUSDAT*: Connect the probe to J7504. Typical RFBUSDAT -signal is shown in figures in section 6.5.9.3 “RFBUSDAT (GSM RX)”.



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- *RFBUSCLK*: Connect the probe to J7505. Typical RFBUSCLK -signal is shown in section 6.5.9.1 "RFBUSCLK (GSM RX)" and 6.5.9.2 "RFBUSCLK and RFBUSENA (GSM RX)"
- *RFBUSENA*: Connect the probe to J7506. Typical RFBUSENA -signal is shown in section 6.5.9.2 "RFBUSCLK and RFBUSENA (GSM RX)"
- *RXRESETX*: Connect the probe to J7515. RXRESETX -signal is a constant 2 V DC-signal after GSM or WCDMA transceiver has been activated the first time after phone boot up. The level of this signal should be about 0 V before transceiver activation.
- *TXRESETX*: Connect the probe to J7517. TXRESETX -signal is a constant 2 V DC-signal after GSM or WCDMA transceiver has been activated the first time after phone boot up. The level of this signal should be about 0 V before transceiver activation.

3.2.2.3 Hinku (N7500) regulator voltage VR1 ok?

- GSM receiver has to be active before Hinku's VR1 voltage can be measured. Procedure is explained in chapter "GSM RX chain activation for manual measurements".
- Measurements can be done with an oscilloscope and a probe.
- Connect the probe to C7504 (or C7505)
- VR1 voltage level should be 2.65 – 2.86 V. Typical value is 2.7 V.

3.2.2.3.1 Hinku (N7500) RB_EXT voltage ok?

- GSM receiver has to be active before Hinku's RB_EXT voltage can be measured. Procedure is explained in chapter "GSM RX chain activation for manual measurements".
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to R7504.
- RB_EXT voltage should be 1.325 – 1.375 V.

3.2.2.3.1.1 VREFRF01-voltage ok?

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to R7503.
- VREFRF01 voltage should be 1.325 – 1.375 V. Typical value is 1.35 V.

3.2.2.3.1.1.1 Desolder R7503. Is VREFRF01 voltage still wrong?

Remember to solder a new component to R7503 pads after measurement.

3.2.2.3.1.1.1.1 Capacitors C7518, C7520 and C7570 working correctly?



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- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that capacitors are not short-circuited. If short-circuit is found replace capacitors mentioned above. If this does not help go to the next step.

3.2.2.3.1.1.1.2 Replace Vinku (N7501) or Hinku (N7500) or both

3.2.2.3.1.1.2 Retu ok?

3.2.2.3.1.2 R7521 and R7504 in place and working correctly?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and check R521 and R504 resistance values with an ohmmeter.

3.2.2.3.1.3 VB_EXT voltage ok?

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7518.
- VB_EXT voltage should be 1.325 – 1.375 V. Typical value is 1.35 V.

3.2.2.3.1.3.1 R7503 in place and working correctly?

- Check that the component is in place and solder joints are ok
- Disconnect the power supply from the phone and check R7503 resistance value with an ohmmeter

3.2.2.3.1.3.2 Capacitors C7518, C7520 and C7570 working correctly?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that capacitors are not short-circuited. If short-circuit is found replace capacitors mentioned above. If this does not help go to the next step.

3.2.2.3.1.3.3 Replace Hinku (N7500) or Vinku (N7501) or both

3.2.2.3.1.4 Replace Hinku (N7500)

3.2.2.3.2 Are capacitors in Hinku (N7500) regulator lines working correctly?

C7504, C7515, C7509, C7508, C7596, C7598 and C7505

- Check that components are in place and solder joints are ok



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- Disconnect the power supply from the phone and use an ohmmeter to check that capacitors are not short-circuited. If short-circuit is found replace capacitors mentioned above. If this does not help go to the next step.

3.2.2.3.3 RX VCO G7500 ok?

3.2.2.3.4 Replace Hinku (N7500)

3.2.2.4 VXO-voltage ok? (=Vdig).

- Measurement can be done with an oscilloscope and a probe
- Connect the probe to C7560 (or C7526, C7513)
- VXO-voltage should be about 2.5 V

3.2.2.5 VCP1-voltage ok?

- GSM receiver has to be active before VCP1 voltage can be measured. Procedure is explained in chapter “GSM RX chain activation for manual measurements”.
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7507.
- VCP1 voltage should be about 4.75 V.

3.2.2.5.1 C7507 and C2222 working properly?

- Check that the components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that C507 and C2222 are not short-circuited.

3.2.2.5.2 Retu ok?

3.2.2.5.3 Hinku (N7500) ok?

3.2.2.6 VCTCXO frequency and output level correct?

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7529 (or C7582)
- The frequency of the VCTCXO should be quite exactly 38.4 MHz and level about 0.5 - 0.9 Vpp. Example of the correct VCTCXO output signal is presented in figure 6.5.1 "VCTCXO Output (DC Offset 1.24 V)".



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3.2.2.6.1 VXO-voltage ok? (=Vdig).

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7529 (or C7582)
- The frequency of the VCTCXO should be quite exactly 38.4 MHz and level about 0.5 - 0.9 Vpp. Example of the correct VCTCXO output signal is presented in figure 6.5.1 "VCTCXO Output (DC Offset 1.24 V)".

3.2.2.6.2 BB AFC-voltage ok?

- Measurement can be done with an oscilloscope and a probe
- Connect the probe to R7509 (or C7533)
- AFC-voltage may vary between 0.1 - 2.3 V. Typical value is 1.2 V. Phoenix “RF Controls” tool can be used to change the AFC value. Voltage level should be about 0.1 V with AFC value -1024 and about 2.3 V with AFC value 1023.

3.2.2.6.3 Replace VCTCXO G7501

3.2.2.7 Is there RF power in the RX VCO output at all?

- GSM receiver has to be active before RX VCO’s output frequency and output level can be measured. Procedure is explained in chapter “GSM RX chain activation for manual measurements”.
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used RX channel (see chapter “Frequency mappings”).
- Spectrum analyser RBW and VBW = 1 MHz, Span = 0, sweep time 1 ms. Notice that GSM transmission has pulsed nature and VCO output power should be measured during RX is active (triggering needed). Another possibility is to use following settings: RBW = VBW = 1 MHz, Span 200 kHz and sweep time at least 2.5 seconds.
- Connect the RF probe to the T7501 input.
- Check if the frequency of the RX VCO is as expected. If the VCO signal is not found try to use wider span setting. The output level of the VCO should be about -20...-30 dBm.

3.2.2.7.1 RX VCO operating voltage VR1 ok?

- GSM receiver has to be active before Hinku’s VR1 voltage can be measured. Procedure is explained in GSM RX chain activation for manual measurements.
- Measurements can be done with an oscilloscope and a probe.
- Connect the probe to C7504 (or C7505) VR1 voltage level should be 2.65 – 2.86 V. Typical value is 2.7 V.



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3.2.2.7.2 Replace RX VCO (G7500)

3.2.2.8 Is RX VCO RF-signal coming to the Hinku at all?

- GSM receiver has to be active before RX VCO's output frequency and output level can be measured. Procedure is explained in chapter "GSM RX chain activation for manual measurements".
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used RX channel (see chapter "Frequency mappings").
- Spectrum analyser RBW and VBW = 1 MHz, Span = 0, sweep time 1 ms. Notice that GSM transmission has pulsed nature and VCO output power should be measured during RX is active (triggering needed). Another possibility is to use following settings: RBW = VBW = 1 MHz, Span 200 kHz and sweep time at least 2.5 seconds.
- Check the level of the VCO frequency in T7501 outputs. The level should be about -25...-35 dBm in both output lines. If the signal level is correct in the input (about -20...-30 dBm) but output level is not as expected then replace T7501.

3.2.2.8.1 Replace balun T7501

3.2.2.9 Is RX VCO frequency as expected?

- GSM receiver has to be active before RX VCO's output frequency and output level can be measured. Procedure is explained in chapter "GSM RX chain activation for manual measurements".
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used RX channel (see chapter "Frequency mappings").
- Spectrum analyser RBW and VBW = 1 MHz, Span = 0, sweep time 1 ms. Notice that GSM transmission has pulsed nature and VCO output power should be measured during RX is active (triggering needed). Another possibility is to use following settings: RBW = VBW = 1 MHz, Span 200 kHz and sweep time at least 2.5 seconds.
- Connect the RF probe to the T7501 input.
- Check if the frequency of the RX VCO is as expected. If the VCO signal is not found try to use wider span setting. The output level of the VCO should be about -20...-30 dBm.

3.2.2.9.1 RX VCO control voltage VC ok?

- GSM receiver has to be active before RX VCO control voltage VC can be measured. Procedure is explained in chapter "GSM RX chain activation for manual measurements".
- Measurement can be done with an oscilloscope and a probe.



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- Connect the probe to R7501.
- Typical RX VCO control voltage VC should look somehow similar to figure 6.5.7 "RX VC in GSM mode (DC Offset 1.5 V)". VC voltage should be between 0.7 - 3.8 V. DC voltage level should change if RX channel is changed. VC is lower on lower channels and higher if higher channel numbers are used.

3.2.2.9.1.1 VCP1-voltage ok?

- GSM receiver has to be active before VCP1 voltage can be measured. Procedure is explained in chapter “GSM RX chain activation for manual measurements”.
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7507.
- VCP1 voltage should be about 4.75 V.

3.2.2.9.1.2 Hinku (N7500) RB_EXT voltage ok?

- GSM receiver has to be active before Hinku’s RB_EXT voltage can be measured. Procedure is explained in chapter “GSM RX chain activation for manual measurements”.
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to R7504.
- RB_EXT voltage should be 1.325 – 1.375 V.

3.2.2.9.1.3 Balun T7501 ok?

- GSM receiver has to be active before RX VCO’s output frequency and output level can be measured. Procedure is explained in chapter “GSM RX chain activation for manual measurements”.
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used RX channel (see chapter “Frequency mappings”).
- Spectrum analyser RBW and VBW = 1 MHz, Span = 0, sweep time 1 ms. Notice that GSM transmission has pulsed nature and VCO output power should be measured during RX is active (triggering needed). Another possibility is to use following settings: RBW = VBW = 1 MHz, Span 200 kHz and sweep time at least 2.5 seconds.
- Check the level of the VCO frequency in T7501 outputs. The level should be about -25...-35 dBm in both output lines. If the signal level is correct in the input (about -20...-30 dBm) but output level is not as expected then replace T7501.



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3.2.2.9.1.4 Are components near the RX VCO ok?

R7501, C7516, R7505, C7524 and C7522 working correctly?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and check resistors resistance values with an ohmmeter.
- Use an ohmmeter to check also that capacitors are not short-circuited

3.2.2.9.1.5 Replace Hinku (N7500) or RX VCO (G7500) or both

3.2.2.9.2 Replace RX VCO G7500

3.2.2.10 Is RX VCO signal level in the T7501 output high enough?

- GSM receiver has to be active before RX VCO's output frequency and output level can be measured. Procedure is explained in chapter "GSM RX chain activation for manual measurements".
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used RX channel (see chapter "Frequency mappings").
- Spectrum analyser RBW and VBW = 1 MHz, Span = 0, sweep time 1 ms. Notice that GSM transmission has pulsed nature and VCO output power should be measured during RX is active (triggering needed). Another possibility is to use following settings: RBW = VBW = 1 MHz, Span 200 kHz and sweep time at least 2.5 seconds.
- Check the level of the VCO frequency in T7501 outputs. The level should be about -25...-35 dBm in both output lines. If the signal level is correct in the input (about -20...-30 dBm) but output level is not as expected then replace T7501.

3.2.2.10.1 RX VCO G7500 output level high enough?

- GSM receiver has to be active before RX VCO's output frequency and output level can be measured. Procedure is explained in chapter "GSM RX chain activation for manual measurements".
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used RX channel (see chapter "Frequency mappings").
- Spectrum analyser RBW and VBW = 1 MHz, Span = 0, sweep time 1 ms. Notice that GSM transmission has pulsed nature and VCO output power should be measured during RX is active (triggering needed). Another possibility is to use following settings: RBW = VBW = 1 MHz, Span 200 kHz and sweep time at least 2.5 seconds.
- Connect the RF probe to the T7501 input.



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- Check if the frequency of the RX VCO is as expected. If the VCO signal is not found try to use wider span setting. Output level of the VCO should be about -20...-30 dBm.

3.2.2.10.1.1 Replace RX VCO G7500

3.2.2.10.2 Replace balun T7501

3.2.2.11 VCTCXO frequency and output level correct?

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7529 (or C7582)
- The frequency of the VCTCXO should be quite exactly 38.4 MHz and level about 0.5 - 0.9 Vpp. Example of the correct VCTCXO output signal is presented in figure 6.5.1 "VCTCXO Output (DC Offset 1.24 V)".

3.2.2.11.1 VXO-voltage ok? (=Vdig).

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7529 (or C7582)
- The frequency of the VCTCXO should be quite exactly 38.4 MHz and level about 0.5 - 0.9 Vpp. Example of the correct VCTCXO output signal is presented in figure 6.5.1 "VCTCXO Output (DC Offset 1.24 V)".

3.2.2.11.2 BB AFC-voltage ok?

- Measurement can be done with an oscilloscope and a probe
- Connect the probe to R7509 (or C7533)
- AFC-voltage may vary between 0.1 - 2.3 V. Typical value is 1.2 V. Phoenix “RF Controls” tool can be used to change the AFC value. Voltage level should be about 0.1 V with AFC value -1024 and about 2.3 V with AFC value 1023.

3.2.2.11.3 Replace VCTCXO G7501

3.2.2.12 Replace Hinku ASIC (N7500)

3.2.3 Is RAP3G ASIC getting ok VREFCM-signal from Hinku (N7500)? Signal level ok?

- GSM receiver has to be active before VREFCM signal can be measured. Procedure is explained in chapter “GSM RX chain activation for manual measurements”.
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to J7516.



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- VREFCM voltage should be about 780 mV (continuous voltage).

3.2.3.1 Hinku (N7500) RB_EXT voltage ok?

- GSM receiver has to be active before Hinku's RB_EXT voltage can be measured. Procedure is explained in chapter "GSM RX chain activation for manual measurements".
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to R7504.
- RB_EXT voltage should be 1.325 – 1.375 V.

3.2.3.2 Replace Hinku (N7500)

- Also RAP3G can be faulty but it's not possible to replace this component

3.2.4 RAP3G faulty?

- Not possible to replace!

### 3.3 GSM Transmitter phase error ok?

- GSM transmitter has to be active before measurements. Procedure is explained in chapter "General instructions for TX troubleshooting". Change TX data type to "Random" in Phoenix.
- Measurement can be done with a GSM transmitter tester or other GSM communication tester. Trigger to TX burst midamble should be used.
- Attach the phone to the product specific test jig (AD-23) and the RF-measurement device to the RF-coupler. Remember that there are two antenna connectors in the coupler, one for GSM and one for WCDMA. Coupler attenuation should be also taken into account during measurements.
- The RMS Phase error shall not be greater than 5° and the peak phase error not greater than 20°.
- If phase error is not as expected separate the phone into parts and place to the MJ-26 module jig (*Notice that there are three antenna connectors in the module jig, one for GSM, one for WCDMA and one for Bluetooth. Make sure that all connections are made to the correct RF-connector*).

3.3.1 Are capacitors in Vinku REG1 and REG2 lines in place?

C7554, C7555 and C7547 (DCS1800 and PCS1900: also C7552)

- Check that components are in place and solder joints are ok



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3.3.2 Are capacitors in GSM PA power supply line in place?

- C7569 and C7583
- Check that component is in place and solder joints are ok

3.3.3 Are TX-IQ signals ok?

- These current mode signals are not possible to measure, but are tested with self-tests. So if there is no fail in 2.4 "ST_CDSP_TX_IQ_TEST" these signals should be ok. Otherwise Vinku (N7501) or RAP3G (D2800) is faulty. Notice that it is not possible to replace RAP3G ASIC.

3.3.3.1.1 Vinku (N7501) RB_EXT voltage ok?

- GSM transmitter has to be active before Vinku's RB_EXT voltage can be measured. Procedure is explained in chapter "General instructions for TX troubleshooting".
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to R7521.
- RB_EXT voltage should be 1.325 – 1.375 V.

3.3.3.2 Replace Vinku (N7501)

- Also RAP3G can be faulty but it is not possible to replace this component

3.3.4 Is TX VCO signal level in the T7503 output high enough?

- GSM transmitter has to be active before TX VCO's output level can be measured. Procedure is explained in chapter "General instructions for TX troubleshooting".
- Measurements can be done with a spectrum analyser and an RF probe. RBW and VBW = 1 MHz, Span = 0, sweep time 1 ms. Spectrum analyser centre frequency should be set according the used TX channel (see chapter "Frequency mappings"). Notice that GSM transmission has pulsed nature and VCO output power should be measured during TX burst (triggering needed). Another possibility is to use following settings: RBW = VBW = 1 MHz, Span 200 kHz and sweep time at least 2.5 seconds.
- Check the level of the VCO frequency in T7503 outputs. The level should be about -30...-35 dBm in both output lines during GSM TX burst. If the signal level is correct in the input (about -25 dBm) but output level is not as expected then replace T7503. VCO shield has to be removed before measurement. Remember to solder the shield back after the phone repairing.

3.3.5 VCTCXO frequency and output level correct?

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7529 (or C7582)



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- The frequency of the VCTCXO should be quite exactly 38.4 MHz and level about 0.5 - 0.9 Vpp. Example of the correct VCTCXO output signal is presented in figure 6.5.1 "VCTCXO Output (DC Offset 1.24 V)".

### 3.4 GSM (GMSK) modulation spectrum ok?

- GSM transmitter has to be active before measurements. Procedure is explained in chapter "General instructions for TX troubleshooting".
- Measurement can be done with a GSM transmitter tester or other GSM communication tester. Settings have to be done according to the 3GPP specifications. Modulation spectrum measurement is possible to perform also with a spectrum analyser, but in this case measurement settings have to be done manually.
- Attach the phone to the product specific test jig (AD-23) and the RF-test device to the RF-coupler. Remember that there are two antenna connectors in the coupler, one for GSM and one for WCDMA. Coupler attenuation should be also taken into account during measurements.

- Set TX Data Type to "Random" in Phoenix
- Enter correct "Centre frequency" to the spectrum analyser (see chapter "Frequency mappings") and "Span" should be set to 2 MHz. "RBW" and "VBW" should be set to 30 kHz.
- Select a correct attenuator in the spectrum analyser and set "reference level offset" according attenuation between the phone and the spectrum analyser.
- Enter "Sweep time" at least to 2.5 s.
- Check that the TX power is not over the specification limits in following offsets (tables below). If the measurement is performed with a spectrum analyser according above settings then there may be 1 to 3 dB exceeding with some limit values. This is caused because above settings are meant only for fast modulation spectrum checking and are not exactly done according 3GPP specification.

EGSM900/DCS1800:

| Offset (kHz) | 100 | 200 | 250 | 400 | ≥ 600 < 1 800 |
|---|---|---|---|---|---|
| Limit (dBc) | +0,5 | -30 | -33 | -60 | -60 |

PCS1900:

| Offset (kHz) | 100 | 200 | 250 | 400 | □ 600 < 1 200 | □ 1 200 < 1 800 |
|---|---|---|---|---|---|---|
| Limit (dBc) | +0,5 | -30 | -33 | -60 | -60 | -60 |



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One example of measured GSM Modulation Spectrum in EGSM900 band is presented in figure 6.5.8 "TX Modulation spectrum (GSM)"..

- If modulation spectrum is not as expected separate the phone into parts and place to the MJ-26 module jig (*Notice that there are three antenna connectors in the module jig, one for GSM, one for WCDMA and one for Bluetooth. Make sure that all connections are made to the correct RF-connector*).

3.4.1 Are components in GSM power control loop in place and working ok?

R7516 and C7559

- Disconnect the power supply from the phone and use an ohmmeter to check that C7559 is not short-circuited. If short-circuit is found replace the capacitor. Check R7516 resistance value with an ohmmeter and replace resistor if needed.

3.4.2 Does GSM PA (N7502) get correct bias currents? Is the level of bias currents ok?

EGSM: Icont_21 and Icont_22
DCS1800/PCS1900: Icont_31 and Icont_32

- GSM transmitter has to be active before measurements. Procedure is explained in chapter “General instructions for TX troubleshooting”.
- Set TX power level to the maximum (“5” in EGSM900 and “0” in DCS1800/PCS1900)
- Measurements can be done with an oscilloscope and a VOLTAGE probe.
- EGSM900:

- Connect the probe to C7545 or C7544. Notice: C7544 is a non-assembled component so the probe should be connected to the pad that can be still found from the PWB

- Typical full TX power bias currents (Icont_21 and Icont_22) should look somehow similar to figure 6.5.4 "Icont_21/Icont_22 (DC Offset 1.2 V)" when measured with an oscilloscope and a probe. Check both currents.

- DCS1800 or PCS1900:

- Connect the probe to C7561 or C7556. Notice: C7556 is a non-assembled component so the probe should be connected to the pad that can be still found from the PWB

Typical full TX power bias currents (Icont_31 and Icont_32) should look somehow similar to figure 6.5.5 "Icont_31/Icont_32 (DC Offset 1.2 V)" when measured with an oscilloscope and a probe. Check both currents.



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3.4.3 Are TX-IQ signals ok?

- These current mode signals are not possible to measure, but are tested with self-tests. So if there is no fail in 2.4 "ST_CDSP_TX_IQ_TEST" these signals should be ok. Otherwise Vinku (N7501) or RAP3G (D2800) is faulty. Notice that it is not possible to replace RAP3G ASIC.

3.4.3.1.1 Vinku (N7501) RB_EXT voltage ok?

- GSM transmitter has to be active before Vinku's RB_EXT voltage can be measured. Procedure is explained in section "General instructions for TX troubleshooting".
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to R7521.
- RB_EXT voltage should be 1.325 – 1.375 V.

3.4.3.2 Replace Vinku (N7501)

- Also RAP3G can be faulty but it is not possible to replace this component

3.4.4 Is TX VCO signal level in the T7503 output high enough?

- GSM transmitter has to be active before TX VCO's output level can be measured. Procedure is explained in section "General instructions for TX troubleshooting".
- Measurements can be done with a spectrum analyser and an RF probe. RBW and VBW = 1 MHz, Span = 0, sweep time 1 ms. Spectrum analyser centre frequency should be set according the used TX channel (see chapter "Frequency mappings"). Notice that GSM transmission has pulsed nature and VCO output power should be measured during TX burst (triggering needed). Another possibility is to use following settings: RBW = VBW = 1 MHz, Span 200 kHz and sweep time at least 2.5 seconds.
- Check the level of the VCO frequency in T7503 outputs. The level should be about -30...-35 dBm in both output lines during GSM TX burst. If the signal level is correct in the input (about -25 dBm) but output level is not as expected then replace T7503. VCO shield has to be removed before measurement. Remember to solder the shield back after the phone repairing.

3.4.5 Replace Vinku (N7501) or GSM PA (N7502) or both



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## 3.5 TX power vs. time ok?

This chapter means situation when GSM TX power levels are ok, but burst timing is not correct or power changes during TX burst.

- GSM transmitter has to be active before measurements. Procedure is explained in chapter "General instructions for TX troubleshooting". ***Note!*** *It is probably needed to change the Tx Data Type in Phoenix to "Random" before this measurement can be performed.*
- Measurement can be done with a GSM transmitter tester or other GSM communication tester. Attach the phone to the product specific test jig (AD-23) and the measurement device to the RF-coupler. Remember that there are two antenna connectors in the coupler, one for GSM and one for WCDMA. Coupler attenuation should be also taken into account during measurements.
- If TX power vs. time is not as expected separate the phone into parts and place to the MJ-26 module jig (*Notice that there are three antenna connectors in the module jig, one for GSM, one for WCDMA and one for Bluetooth. Make sure that all connections are made to the correct RF-connector*).

### 3.5.1 Is the TXC-signal coming to Vinku ASIC (N7501) OK?

- GSM transmitter has to be active before TX control voltage TXC can be measured. Procedure is explained in section "General instructions for TX troubleshooting".
- Set TX power level first to the maximum ("5" in EGSM900 and "0" in DCS1800/PCS1900)
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7549
- Typical TX control voltage TXC timing should look somehow similar to figure 6.5.2 "TXC in GSM mode (DC Offset 0 V)" (EGSM900 TX power level 5) and voltage levels should be roughly:

- EGSM900: 1.8 V while TX burst and 0 V otherwise.
- DCS1800/PCS1900: 1.8 V while TX burst and 0 V otherwise.

- Change the TX to the minimum power level ("19" in EGSM and "15" in DCS1800/PCS1900)
- Typical TX control voltage TXC levels should be now about:

- EGSM900: 1.0 V while TX burst and 0 V otherwise.
- DCS1800/PCS1900: 0.7 V while TX burst and 0 V otherwise.



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3.5.2 Does GSM PA (N7502) get correct bias currents? Is the level of bias currents ok?

EGSM: Icont_21 and Icont_22
DCS1800/PCS1900: Icont_31 and Icont_32

- GSM transmitter has to be active before measurements. Procedure is explained in chapter "General instructions for TX troubleshooting".
- Set TX power level to the maximum ("5" in EGSM900 and "0" in DCS1800/PCS1900)
- Measurements can be done with an oscilloscope and a VOLTAGE probe.
- EGSM900:

- Connect the probe to C7545 or C7544. Notice: C7544 is a non-assembled component so the probe should be connected to the pad that can be still found from the PWB

- Typical full TX power bias currents (Icont_21 and Icont_22) should look somehow similar to figure 6.5.4 "Icont_21/Icont_22 (DC Offset 1.2 V)" when measured with an oscilloscope and a probe. Check both currents.

- DCS1800 or PCS1900:

- Connect the probe to C7561 or C7556. Notice: C7556 is a non-assembled component so the probe should be connected to the pad that can be still found from the PWB

- Typical full TX power bias currents (Icont_31 and Icont_32) should look somehow similar to figure 6.5.5 when measured with an oscilloscope and a probe. Check both currents.

3.5.3 Does GSM PA (N7502) get correct DET_SW_G -voltage from Vinku ASIC (N7501)?

- GSM transmitter has to be active before DET_SW_G voltage can be measured. Procedure is explained in section "General instructions for TX troubleshooting".
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7595. Notice: C7595 is a non-assembled component so the probe should be connected to the pad that can be still found from the PWB.
- DET_SW_G voltage should be about 2.8 V while TX burst and 0 V otherwise.

3.5.3.1 Replace Vinku (N7501)

3.5.4 Are components in GSM power control loop in place and working ok?

R7516 and C7559

- Disconnect the power supply from the phone and use an ohmmeter to check that C7559 is not short-circuited. If short-circuit is found replace the capacitor.



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- Check R7516 resistance value with an ohmmeter and replace resistor if needed.



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## 4. DOES THE PHONE REGISTER TO THE NETWORK AND MAKE A CALL (WCDMA)?

- Test against a WCDMA communication tester or real WCDMA network with a proper SIM.

### 4.1 WCDMA TX power and transmit frequency ok?

- Attach the phone to the product specific test jig (AD-23FS) and a spectrum analyser to the RF-coupler. Remember that there are two antenna connectors in the coupler, one for GSM and one for WCDMA. Coupler attenuation should be also taken into account during measurements. This measurement should be done in an RF shield box.
- Close the shield box hatch.
- Set WCDMA TX ON. Procedure is explained in chapter “General instructions for TX troubleshooting”.
- Spectrum analyser centre frequency should be set according the used TX channel (see chapter “Frequency mappings”).
- Spectrum analyser RBW = VBW = 10 MHz, Span ≤ 2 MHz, sweep time 100 ms.
- Test at power level 21 dBm

- The output power should be +17 – +23 dBm, typical value 21 dBm.

- Remember to select “Stop RF” in Phoenix before opening the shield box hatch.
- If power is not as expected separate the phone into parts and place to the MJ-26 module jig. Connect a spectrum analyser to the module jig WCDMA RF connector and measure TX power again (*Notice that there are three antenna connectors in the module jig, one for GSM, one for WCDMA and one for Bluetooth. Make sure that all connections are made to the correct RF-connector*).

- TX power ok in the module jig: Antenna or antenna connection bad. Replace the antenna

- TX power still wrong or no TX signal found at all: Continue troubleshooting

- If TX signal is not found at all use wider span setting and check if the transmitter is transmitting on wrong frequency. If signal is found to be on wrong frequency, see section 4.1.3. "WCDMA transmitter frequency correct?".

#### 4.1.1 Does the WCDMA TX transmit RF-power at all?

- If TX signal is not found at all use wider span setting and check if the transmitter is transmitting on wrong frequency. If signal is found to be on wrong frequency, see section 4.1.3. "WCDMA transmitter frequency correct?".



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#### 4.1.1.1 Is Vinku (N7501) transmitting RF-power at all?

- WCDMA transmitter has to be active before Vinku's output level can be measured. Procedure is explained in chapter "General instructions for TX troubleshooting".
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used TX channel (see chapter "Frequency mappings").
- Spectrum analyser RBW = VBW = 10 MHz, Span ≤ 2 MHz, sweep time 100 ms.
- Connect the RF probe to R7520. The RF-level should be about the same on both ends of the resistor. Check output level with 0 dBm power level (Set start level "0" to Phoenix).

- Power level "0" – Output level should be about -40...-48 dBm

##### 4.1.1.1.1 RF operating voltage VBAT_ASIC ok?

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7503 (or C7501, C7541)
- VBAT_ASIC voltage level should be 3.05 – 5.4 V. Typical value is 4.0 V

##### 4.1.1.1.2 RFBUS signals ok?

- GSM receiver has to be active before RFBUS signals can be measured. Procedure is explained in chapter "GSM RX chain activation for manual measurements". Also WCDMA/GSM transmitter and WCDMA receiver activation can be used for the measurement but then RFBUS -signals don't necessarily look like in figures mentioned below.
- Measurements can be performed with an oscilloscope and a probe. Check all five RF BUS signals:

- *RFBUSDAT*: Connect the probe to J7504. Typical RFBUSDAT -signal is shown in section 6.5.9.3 "RFBUSDAT (GSM RX)"

- *RFBUSCLK*: Connect the probe to J7505. Typical RFBUSCLK -signal is shown in chapters 6.5.9.1 "RFBUSCLK (GSM RX)" and 6.5.9.2 "RFBUSCLK and RFBUSENA (GSM RX)"

- *RFBUSENA*: Connect the probe to J7506. Typical RFBUSENA -signal is shown in chapter 6.5.9.2 "RFBUSCLK and RFBUSENA (GSM RX)"

- *RXRESETX*: Connect the probe to J7515. RXRESETX -signal is a constant 2 V DC-signal after GSM or WCDMA transceiver has been activated the first time after phone boot up. The level of this signal should be about 0 V before transceiver activation.

- *TXRESETX*: Connect the probe to J7517. TXRESETX -signal is a constant 2 V DC-signal after GSM or WCDMA transceiver has been activated the first time after phone boot up. The level of this signal should be about 0 V before transceiver activation



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4.1.1.1.3 Vinku (N7501) regulator voltages VREG1, VREG2 ok?

- WCDMA transmitter has to be active before VREG1 and VREG2 voltages can be measured. Procedure is explained in section “General instructions for TX troubleshooting”.. Measurements can be done with an oscilloscope and a probe.
- VREG1: Connect the probe to C7543
- VREG2: Connect the probe to C7548 (or C7547)
- VREG1 and VREG2 voltage levels should be 2.65 – 2.86 V. Typical value is 2.7 V.

4.1.1.1.3.1 Vinku (N7501) RB_EXT voltage ok?

- WCDMA transmitter has to be active before Vinku’s RB_EXT voltage can be measured. Procedure is explained in section “General instructions for TX troubleshooting”.
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to R7521.
- RB_EXT voltage should be 1.325 – 1.375 V.

4.1.1.1.3.1.1 VREFRF01-voltage ok?

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to R7503.
- VREFRF01 voltage should be 1.325 – 1.375 V. Typical value is 1.35 V.

4.1.1.1.3.1.1.1 Desolder R7503. Is VREFRF01 voltage still wrong?

- Remember to solder a new component to R7503 pads after measurement.

4.1.1.1.3.1.1.1.1 Capacitors C7518, C7520 and C7570 working correctly?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that capacitors are not short-circuited. If short-circuit is found replace capacitors mentioned above. If this does not help go to the next step.

4.1.1.1.3.1.1.1.2 Replace Vinku (N7501) or Hinku (N7500) or both

4.1.1.1.3.1.1.2 Retu ok?



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4.1.1.1.3.1.2 R7521 and R7504 in place and working correctly?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and check R7521 and R7504 resistance values with an ohmmeter.

4.1.1.1.3.1.3 VB_EXT voltage ok?

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7518.
- VB_EXT voltage should be 1.325 – 1.375 V. Typical value is 1.35 V.

4.1.1.1.3.1.3.1 R7503 in place and working correctly?

- Check that the component is in place and solder joints are ok
- Disconnect the power supply from the phone and check R7503 resistance value with an ohmmeter

4.1.1.1.3.1.3.2 Capacitors C7518, C7520 and C7570 working correctly?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that capacitors are not short-circuited. If short-circuit is found replace capacitors mentioned above. If this does not help go to the next step.

4.1.1.1.3.1.3.3 Replace Vinku (N7501) or Hinku (N7500) or both

4.1.1.1.3.1.4 Replace Vinku (N7501)

4.1.1.1.3.2 Are capacitors in Vinku (N7501) regulator lines working correctly?

VREG1: C7543

VREG2: C7547, C7548, C7554, C7555, C7553, C7552, C7558 and C7567

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that regulator lines are not short-circuited to the ground. If short-circuit is found replace capacitors mentioned above. If this does not help go to the next step.

4.1.1.1.3.3 TX VCO (G7502) ok?

4.1.1.1.3.4 Replace Vinku (N7501)



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4.1.1.1.4 VXO-voltage ok? (=Vdig).

- Measurement can be done with an oscilloscope and a probe
- Connect the probe to C7560 (or C7526, C7513)
- VXO-voltage should be about 2.5 V

4.1.1.1.5 VCP2-voltage ok?

- WCDMA transmitter has to be active before VCP2 voltage can be measured. Procedure is explained in section “General instructions for TX troubleshooting”.
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C2221 (or C7550).
- VCP2 voltage should be about 4.75 V.

4.1.1.1.5.1 C7550 short-circuited?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that C7550 is not short-circuited. If short-circuit is found replace the capacitor mentioned above. If this does not help go to the next step.

4.1.1.1.5.2 Retu ok?

4.1.1.1.5.3 Vinku (N7501) ok?

4.1.1.1.6 Is there RF power in the TX VCO output at all?

- WCDMA transmitter has to be active before TX VCO’s output level can be measured. Procedure is explained in chapter “General instructions for TX troubleshooting”.
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used TX channel (see chapter “Frequency mappings”). RBW and VBW = 1 MHz, Span ≤ 200 kHz.
- Connect the RF probe to the T7503 input. VCO shield has to be removed before measurement. Remember to solder the shield back after the phone repairing. *Quick VCO alive check can be done without removing the RF shield. The RF probe should be placed as near the TX VCO output as possible (Put the head of the probe carefully inside the VCO can through the holes of the shield). This method can be used only to check that the TX VCO is alive. Remember to use low RF Attenuator value in the spectrum analyser with this method.*
- Check if the frequency of the TX VCO is as expected. If the VCO signal is not found try to use wider span setting. The correct VCO frequency can be found in see chapter “Frequency mappings”. The output level of the VCO should be about -25 dBm.



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4.1.1.1.6.1 TX VCO operating voltage VREG2 (VR2) ok?

- GSM transmitter has to be active before VREG1 and VREG2 voltages can be measured. Procedure is explained in chapter “General instructions for TX troubleshooting”.
- Measurements can be done with an oscilloscope and a probe.
- VREG1: Connect the probe to C7543
- VREG2: Connect the probe to C7548 (or C7547)
- VREG1 and VREG2 voltage levels should be 2.65 – 2.86 V. Typical value is 2.7 V.

4.1.1.1.6.2 Replace TX VCO (G7502)

4.1.1.1.7 Is TX VCO RF-signal coming to the Vinku at all?

- WCDMA transmitter has to be active before TX VCO’s output level can be measured. Procedure is explained in chapter “General instructions for TX troubleshooting”.
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used TX channel (see chapter “Frequency mappings”). RBW and VBW = 1 MHz, Span ≤ 200 kHz.
- Check the level of the TX VCO frequency in T7503 outputs. The level should be about -30...-35 dBm in both output lines. If the signal level is correct in the input (about -25 dBm) but output level is not as expected then replace T7503. VCO shield has to be removed before measurement. Remember to solder the shield back after the phone repairing.

4.1.1.1.7.1 Replace balun T7503

4.1.1.1.8 Are TX-IQ signals ok?

- These current mode signals are not possible to measure, but are tested with self-tests. So if there is no fail in 2.4. “ST_CDSP_TX_IQ_TEST” these signals should be ok. Otherwise Vinku (N7501) or RAP3G (D2800) is faulty. Notice that it is not possible to replace RAP3G ASIC.

4.1.1.1.9 Is the TXC-signal coming to Vinku ASIC (N7501) OK?

- WCDMA transmitter has to be active before TX control voltage TXC can be measured. Procedure is explained in chapter “General instructions for TX troubleshooting”.
- Set TX power level to -50 dBm (Set start level “-50” to Phoenix)
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7549



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- TX control voltage TXC should be constant DC-voltage between 0.1 - 2.3 V. Voltage level should change if TX power is changed. TXC is lower on lower power levels and higher if higher power levels are used.
- TXC voltage should be about 1.0 V with power level -50 dBm and about 1.5 V with power level 0 dBm.

4.1.1.1.9.1 R7514 in place and working correctly?

- Check that the component is in place and solder joints are ok
- Disconnect the power supply from the phone and check R7514 resistance value with an ohmmeter

4.1.1.1.9.2 C7549 working correctly?

- Check that the component is in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that C7549 is not short-circuited.

4.1.1.1.9.3 Retu ok?

4.1.1.1.10 WCDMA-modulator supply voltage (VREG2) ok?

- WCDMA transmitter has to be active before measurements. Procedure is explained in chapter “General instructions for TX troubleshooting”.
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to R7520
- DC voltage level should be 2.65 – 2.86 V in both R7520 pads. Typical value is 2.7 V.

4.1.1.1.10.1 Inductors L7512 and L7510 in place and working correctly?

- Disconnect the power supply from the phone and use an ohmmeter to check that L7510 and L7512 are conducting DC.

4.1.1.1.11 VCTCXO frequency and output level ok?

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7529 (or C7582)
- The frequency of the VCTCXO should be quite exactly 38.4 MHz and level about 0.5 - 0.9 Vpp. Example of the correct VCTCXO output signal is presented in figure 6.5.1 "VCTCXO Output (DC Offset 1.24 V)".



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4.1.1.1.11.1 VXO-voltage ok? (=Vdig).

- Measurement can be done with an oscilloscope and a probe
- Connect the probe to C7560 (or C7526, C7513)
- VXO-voltage should be about 2.5 V

4.1.1.1.11.2 BB AFC-voltage ok?

- Measurement can be done with an oscilloscope and a probe
- Connect the probe to R7509 (or C7533)
- AFC-voltage may vary between 0.1 - 2.3 V. Typical value is 1.2 V. Phoenix “RF Controls” tool can be used to change the AFC value. Voltage level should be about 0.1 V with AFC value -1024 and about 2.3 V with AFC value 1023.

4.1.1.1.11.3 Replace VCTCXO G7501

4.1.1.1.12 Replace Vinku (N7501)

4.1.1.2 Is there RF-power in the WCDMA PA (N7503) input at all?

- WCDMA transmitter has to be active before measurements. Procedure is explained in chapter “General instructions for TX troubleshooting”.
- Set TX power level to 0 dBm (Set start level “0” to Phoenix)
- Measurements can be done with a spectrum analyser and an RF probe. Remember to make correct frequency setting to the spectrum analyser. Spectrum analyser centre frequency should be set according the used TX channel (see chapter “Frequency mappings”).
- Spectrum analyser RBW = VBW = 10 MHz, Span ≤ 2 MHz, sweep time 100 ms
- Connect the probe to Z7506 output. The RF level should be roughly -40...-48 dBm.

4.1.1.2.1 Is Vinku (N7501) output RF-signal coming correctly to the Z7506 (SAW filter)?

- WCDMA transmitter has to be active before measurements. Procedure is explained in chapter “General instructions for TX troubleshooting”.
- Set TX power level to 0 dBm (Set start level “0” to Phoenix)
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used TX channel (see chapter “Frequency mappings”).
- Spectrum analyser RBW = VBW = 10 MHz, Span ≤ 2 MHz, sweep time 100 ms



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- Connect the RF probe to L7511. The RF-level should be about the same on both ends of the inductor. Check the level with 0 dBm power level (Set start level “0” to Phoenix).
- Power level “0” – Vinku output level should be about -40...-48 dBm

4.1.1.2.1.1 Inductor L7511 and resistor R7520 in place and working correctly?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and check R7520 resistance value with an ohmmeter.
- If resistance of R7520 is correct then replace L7511.

4.1.1.3 Is WCDMA PA (N7503) transmitting RF-power at all?

- WCDMA transmitter has to be active before measurements. Procedure is explained in chapter “General instructions for TX troubleshooting”.
- Set TX power level to 0 dBm (Set start level “0” to Phoenix)
- Measurements can be done with a spectrum analyser and an RF probe. Remember to make correct frequency setting to the spectrum analyser. Spectrum analyser centre frequency should be set according the used TX channel (see chapter “Frequency mappings”).
- Spectrum analyser RBW = VBW = 10 MHz, Span ≤ 2 MHz, sweep time 100 ms
- Connect the probe to Z7505 input. The RF level should be roughly -16...-28 dBm.

4.1.1.3.1 Does WCDMA PA (N7503) get operating voltage Vcc12?

- WCDMA transmitter has to be active before measurements. Procedure is explained in chapter “General instructions for TX troubleshooting”.
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to R7525
- Vcc12 voltage level should be 3.05 – 5.4 V. Typical value is 4.0 V.

4.1.1.3.1.1 R7525 in place and working correctly?

- Check that the component is in place and solder joints are ok
- Disconnect the power supply from the phone and check R7525 resistance value with an ohmmeter



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4.1.1.3.1.2 PA operating voltage VBAT_PA ok?

- WCDMA transmitter has to be active before measurements. Procedure is explained in chapter “General instructions for TX troubleshooting”.
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7569 (or C7564, C7583)
- Voltage level should be 3.05 – 5.4 V. Typical value is 4.0 V.

4.1.1.3.1.2.1 Ferrite Z7500 ok?

- Check that component is in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that inductor is conducting DC.

4.1.1.3.2 Does WCDMA PA (N7503) get operating voltage Vcc11?

- WCDMA transmitter has to be active before measurements. Procedure is explained in chapter “General instructions for TX troubleshooting”.
- Set TX power level to -40 dBm (Set start level to “-40.0” in Phoenix)
- Measurements can be done with an oscilloscope and a probe.
- Connect the probe to C7580.
- Vcc11 voltage level should be about 1.5 V. The same voltage level should be measured also with all power levels smaller than about 10 dBm. Vcc11 is about 3.3 V with the highest power (21 dBm). NOTE: Perform WCDMA transmitter tests with > 0 dBm power only in RF shielded environment.

4.1.1.3.2.1 L7515, C7589 and C7580 in place and working correctly?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that L7515 is conducting DC.
- Use an ohmmeter also to check that capacitors are not short-circuited. If short-circuit is found replace capacitors mentioned above.

4.1.1.3.2.2 Does SMPS N7504 get operating voltage Vdd (=VBAT_PA)?

- WCDMA transmitter has to be active before measurements. Procedure is explained in chapter “General instructions for TX troubleshooting”.
- Measurement can be done with an oscilloscope and a probe.



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- Connect the probe to C7569 (or C7564, C7583)
- VBAT_PA voltage level should be 3.05 – 5.4 V. Typical value is 4.0 V.

4.1.1.3.2.3 Is there correct DET_SW_W –voltage coming from Vinku ASIC (N7501)?

- WCDMA transmitter has to be active before measurements. Procedure is explained in chapter “General instructions for TX troubleshooting”.
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7586.
- Voltage level should be about 2.78 V.

4.1.1.3.2.3.1 Replace Vinku (N7501)

4.1.1.3.2.4 Does SMPS get correct control voltage from the WCDMA power detector (signal Vcontrol)?

- WCDMA transmitter has to be active before measurements. Procedure is explained in chapter “General instructions for TX troubleshooting”.
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7591.
- Vcontrol signal should be constant DC-voltage. Voltage level should change if TX power is changed. Vcontrol is lower on lower power levels and higher if higher power levels are used.
- Vcontrol should be about 570 mV with power level +10 dBm, about 2.0 V with power level +21 dBm and about 200 mV when power levels below 0 dBm are used. NOTE: Perform WCDMA transmitter tests with > 0 dBm power only in RF shielded environment.

4.1.1.3.2.4.1 Is there correct DET_SW_W –voltage coming from Vinku ASIC (N7501)?

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7586.
- Voltage level should be about 2.78 V.

4.1.1.3.2.4.1.1 Replace Vinku (N7501)

4.1.1.3.2.4.2 Check WCDMA power detector components – In place and value correct?

Components L7514, C7585, V7500, R7526, C7586, R7527, C7587, C7590, R7529, R7530, C7591, R7531 and C7592.

- Check that components are in place and solder joints are ok



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- Disconnect the power supply from the phone and check resistors resistance values with an ohmmeter
- Use an ohmmeter also to check that L7514 is conducting DC.

4.1.1.3.2.5 Replace SMPS N7504

4.1.1.3.3 Does WCDMA PA (N7503) get bias currents Icont11 and Icont12?

- WCDMA transmitter has to be active before measurements. Procedure is explained in chapter “General instructions for TX troubleshooting”.
- Set TX power level to -40 dBm (Set start level to “-40.0” in phoenix)
- Measurements can be done with an oscilloscope and a probe.

- Connect the probe to C7579
- WCDMA PA bias current Icont_12 should look as a constant 2.5 - 2.6 V DC-voltage with all power levels.
- Connect the probe to C7576 pad. Notice: C7576 is a non-assembled component so the probe should be connected to the pad that can be still found from the PWB.
- WCDMA PA bias current Icont_11 should look as a constant 2.5 - 2.6 V DC-voltage with all power levels.

4.1.1.3.3.1 Vinku (N7501) RB_EXT voltage ok?

- WCDMA transmitter has to be active before Vinku’s RB_EXT voltage can be measured. Procedure is explained in chapter “General instructions for TX troubleshooting”.
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to R7521.
- RB_EXT voltage should be 1.325 – 1.375 V.

4.1.1.3.3.2 Is capacitor C7579 in WCDMA PA (N7503) bias line working correctly?

Icont_12 missing – C7579 short-circuited?

- Check that component is in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that the capacitor is not short-circuited. If short-circuit is found replace the capacitor. If this does not help go to the next step.



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4.1.1.3.3.3 Replace Vinku (N7501) or WCDMA PA (N7503)

4.1.1.3.4 Replace PA (N7503)

4.1.1.4 Does duplex-filter (Z7502) get correct RF-power level from WCDMA PA (N7503)?

- WCDMA transmitter has to be active before measurements. Procedure is explained in chapter "General instructions for TX troubleshooting".
- Set TX power level to 0 dBm (Set start level "0" to Phoenix)
- Measurements can be done with a spectrum analyser and an RF probe. Remember to make correct frequency setting to the spectrum analyser. Spectrum analyser centre frequency should be set according the used TX channel (see chapter "Frequency mappings").
- Spectrum analyser RBW = VBW = 10 MHz, Span ≤ 2 MHz, sweep time 100 ms
- Connect the probe to Z7502 TX input. The RF level should be roughly -20...-30 dBm.

4.1.1.4.1 Replace isolator Z7505

4.1.1.5 Replace duplex-filter Z7502

4.1.2 Does WCDMA TX transmit enough RF-power and power levels otherwise ok?

4.1.2.1 Is Vinku ASIC (N7501) transmitting correct RF-power?

- WCDMA transmitter has to be active before Vinku's output level can be measured. Procedure is explained in chapter "General instructions for TX troubleshooting".
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser RBW = VBW = 10 MHz, Span ≤ 2 MHz, sweep time 100 ms. Spectrum analyser centre frequency should be set according the used TX channel (see chapter "Frequency mappings").
- Connect the RF probe to R7520. The RF-level should be about the same on both ends of the resistor. Check output level with 0 dBm ("0") power level.

- Power level ("0") – Output level should be about -45...-48 dBm

- Check if output levels of Vinku are as expected.

4.1.2.1.1 RF operating voltage VBAT_ASIC ok?

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7503 (or C7501, C7541)
- VBAT_ASIC voltage level should be 3.05 – 5.4 V. Typical value is 4.0 V.



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4.1.2.1.2 Vinku (N7501) regulator voltages VREG1, VREG2 ok?

- WCDMA transmitter has to be active before VREG1 and VREG2 voltages can be measured. Procedure is explained in chapter “General instructions for TX troubleshooting”. Measurements can be done with an oscilloscope and a probe.
- VREG1: Connect the probe to C7543
- VREG2: Connect the probe to C7548 (or C7547)
- VREG1 and VREG2 voltage levels should be 2.65 – 2.86 V. Typical value is 2.7 V.

4.1.2.1.3 Are TX-IQ signals ok?

- These current mode signals are not possible to measure, but are tested with self-tests. So if there is no fail in 2.4 “ST_CDSP_TX_IQ_TEST” these signals should be ok. Otherwise Vinku (N7501) or RAP3G (D2800) is faulty. Notice that it is not possible to replace RAP3G ASIC.

4.1.2.1.4 Is the TXC-signal coming to Vinku ASIC (N7501) OK? Is signal level correct?

- WCDMA transmitter has to be active before TX control voltage TXC can be measured. Procedure is explained in chapter “General instructions for TX troubleshooting”.
- Set TX power level to -50 dBm (Set start level “-50” to Phoenix)
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7549
- TX control voltage TXC should be constant DC-voltage between 0.1 - 2.3 V. Voltage level should change if TX power is changed. TXC is lower on lower power levels and higher if higher power levels are used.
- TXC voltage should be about 1.0 V with power level -50 dBm and about 1.5 V with power level 0 dBm.

4.1.2.1.4.1 R7514 resistance value correct?

- Check that the component is in place and solder joints are ok
- Disconnect the power supply from the phone and check R7514 resistance value with an ohmmeter

4.1.2.1.4.2 C7549 ok?

- Check that the component is in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that C7549 is not short-circuited.



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4.1.2.1.4.3 Retu ok?

4.1.2.1.5 Does Vinku (N7501) WCDMA-modulator get correct supply voltage (VREG2)?

- WCDMA transmitter has to be active before measurements. Procedure is explained in chapter “General instructions for TX troubleshooting”.
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to R7520
- DC voltage level should be 2.65 – 2.86 V in both R7520 pads. Typical value is 2.7 V.

4.1.2.1.5.1 Inductors L7512 and L7510 in place and working correctly?

- Disconnect the power supply from the phone and use an ohmmeter to check that L7510 and L7512 are conducting DC.

4.1.2.1.6 Is TX VCO signal level in the T7503 output high enough?

- WCDMA transmitter has to be active before TX VCO’s output level can be measured. Procedure is explained in chapter “General instructions for TX troubleshooting”.
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used TX channel (see chapter “Frequency mappings”). RBW and VBW = 1 MHz, Span ≤ 200 kHz.
- Check the level of the VCO frequency in T7503 outputs. The level should be about -30...-35 dBm in both output lines. If the signal level is correct in the input (about -25 dBm) but output level is not as expected then replace T7503. VCO shield has to be removed before measurement. Remember to solder the shield back after the phone repairing.

4.1.2.1.6.1 TX VCO G7502 output level high enough?

- WCDMA transmitter has to be active before TX VCO’s output frequency and output level can be measured. Procedure is explained in chapter “General instructions for TX troubleshooting”.
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used TX channel (see chapter “Frequency mappings”). RBW and VBW = 1 MHz, Span ≤ 200 kHz.
- Connect the RF probe to the T7503 input. VCO shield has to be removed before measurement. Remember to solder the shield back after the phone repairing.
- Check if the frequency of the TX VCO is as expected. If the VCO signal is not found try to use wider span setting. The output level of the VCO should be about -25 dBm.



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4.1.2.1.6.1.1 Replace TX VCO G7502

4.1.2.1.6.2 Replace balun T7503

4.1.2.1.7 Replace Vinku (N7501)

4.1.2.2 Is there correct RF-power in the WCDMA PA (N7503) input?

- WCDMA transmitter has to be active before measurements. Procedure is explained in chapter “General instructions for TX troubleshooting”.
- Set TX power level to 0 dBm (Set start level “0” to Phoenix)
- Measurements can be done with a spectrum analyser and an RF probe. Remember to make correct frequency setting to the spectrum analyser. Spectrum analyser centre frequency should be set according the used TX channel (see chapter “Frequency mappings”).
- Spectrum analyser RBW = VBW = 10 MHz, Span ≤ 2 MHz, sweep time 100 ms.
- Connect the probe to Z7506 output. The RF level should be roughly -40...-48 dBm.

4.1.2.2.1 Is Vinku (N7501) output RF-signal coming correctly to the Z7506 (SAW filter)?

- WCDMA transmitter has to be active before measurements. Procedure is explained in chapter “General instructions for TX troubleshooting”.
- Set TX power level to 0 dBm (Set start level “0” to Phoenix)
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used TX channel (see chapter “Frequency mappings”).
- Spectrum analyser RBW = VBW = 10 MHz, Span ≤ 2 MHz, sweep time 100 ms.
- Connect the RF probe to L7511. The RF-level should be about the same on both ends of the inductor. Check the level with 0 dBm power level (Set start level “0” to Phoenix).
- Power level “0” – Vinku output level should be about -40...-48 dBm

4.1.2.2.1.1 Inductor L7511 and resistor R7520 in place and working correctly?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and check R7520 resistance value with an ohmmeter.
- If resistance of R7520 is correct then replace L7511.



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4.1.2.3 Does WCDMA PA (N7503) transmit correct RF-power?

- WCDMA transmitter has to be active before measurements. Procedure is explained in chapter “General instructions for TX troubleshooting”.
- Set TX power level to 0 dBm (Set start level “0” to Phoenix)
- Measurements can be done with a spectrum analyser and an RF probe. Remember to make correct frequency setting to the spectrum analyser. Spectrum analyser centre frequency should be set according the used TX channel (see chapter “Frequency mappings”).
- Spectrum analyser RBW = VBW = 10 MHz, Span ≤ 2 MHz, sweep time 100 ms.
- Connect the probe to Z7505 input. The RF level should be roughly -16...-28 dBm.

4.1.2.3.1 Does WCDMA PA (N7503) get correct operating voltage Vcc12?

- WCDMA transmitter has to be active before measurements. Procedure is explained in chapter “General instructions for TX troubleshooting”.
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to R7525
- Vcc12 voltage level should be 3.05 – 5.4 V. Typical value is 4.0 V.

4.1.2.3.1.1 R7525 in place and working correctly?

- Check that the component is in place and solder joints are ok
- Disconnect the power supply from the phone and check R7525 resistance value with an ohmmeter

4.1.2.3.1.2 PA operating voltage VBAT_PA ok?

- WCDMA transmitter has to be active before measurements. Procedure is explained in chapter “General instructions for TX troubleshooting”.
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7569 (or C7564, C7583)
- Voltage level should be 3.05 – 5.4 V. Typical value is 4.0 V.

4.1.2.3.1.2.1 Ferrite Z7500 ok?

- Check that component is in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that inductor is conducting DC.



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4.1.2.3.2 Does WCDMA PA (N7503) get correct operating voltage Vcc11?

- WCDMA transmitter has to be active before measurements. Procedure is explained in chapter “General instructions for TX troubleshooting”.
- Set TX power level to -40 dBm (Set start level to “-40.0” in Phoenix)
- Measurements can be done with an oscilloscope and a probe.
- Connect the probe to C7580.
- Vcc11 voltage level should be about 1.5 V. The same voltage level should be measured also with all power levels smaller than about 10 dBm. Vcc11 is about 3.3 V with the highest power (21 dBm). NOTE: Perform WCDMA transmitter tests with > 0 dBm power only in RF shielded environment.

4.1.2.3.2.1 L7515, C7589 and C7580 in place and working correctly?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that L7515 is conducting DC.
- Use an ohmmeter also to check that capacitors are not short-circuited. If short-circuit is found replace capacitors mentioned above.

4.1.2.3.2.2 Does SMPS N7504 get operating voltage Vdd (=VBAT_PA)?

- WCDMA transmitter has to be active before measurements. Procedure is explained in chapter “General instructions for TX troubleshooting”.
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7569 (or C7564, C7583)
- VBAT_PA voltage level should be 3.05 – 5.4 V. Typical value is 4.0 V.

4.1.2.3.2.3 Is there correct DET_SW_W –voltage coming from Vinku ASIC (N7501)?

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7586.
- Voltage level should be about 2.78 V.

4.1.2.3.2.3.1 Replace Vinku (N7501)



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4.1.2.3.2.4 Does SMPS get correct control voltage from the WCDMA power detector (signal Vcontrol)?

- WCDMA transmitter has to be active before measurements. Procedure is explained in chapter “General instructions for TX troubleshooting”.
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7591.
- Vcontrol signal should be constant DC-voltage. Voltage level should change if TX power is changed. Vcontrol is lower on lower power levels and higher if higher power levels are used.
- Vcontrol should be about 570 mV with power level +10 dBm, about 2.0 V with power level +21 dBm and about 200 mV when power levels below 0 dBm are used. NOTE: Perform WCDMA transmitter tests with > 0 dBm power only in RF shielded environment.

4.1.2.3.2.4.1 Is there correct DET_SW_W –voltage coming from Vinku ASIC (N7501)?

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7586.
- Voltage level should be about 2.78 V.

4.1.2.3.2.4.1.1 Replace Vinku (N7501)

4.1.2.3.2.4.2 Check WCDMA power detector components – In place and value correct?

Components L7514, C7585, V7500, R7526, C7586, R7527, C7587, C7590, R7529, R7530, C7591, R7531 and C7592.

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and check resistors resistance values with an ohmmeter
- Use an ohmmeter to check that L7514 is conducting DC.
- Use a diode meter to make sure that diodes inside V7500 are working correctly.

4.1.2.3.2.5 Replace SMPS N7504

4.1.2.3.3 Does WCDMA PA (N7503) get bias currents Icont11 and Icont12?

- WCDMA transmitter has to be active before measurements. Procedure is explained in chapter “General instructions for TX troubleshooting”.
- Set TX power level to -40 dBm (Set start level to “-40.0” in phoenix)



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- Measurements can be done with an oscilloscope and a probe.
- Connect the probe to C7579
- WCDMA PA bias current Icont_12 should look as a constant 2.5 - 2.6 V DC-voltage with all power levels.
- Connect the probe to C7576 pad. Notice: C7576 is a non-assembled component so the probe should be connected to the pad that can be still found from the PWB.
- WCDMA PA bias current Icont_11 should look as a constant 2.5 - 2.6 V DC-voltage with all power levels.

4.1.2.3.3.1 Vinku (N7501) RB_EXT voltage ok?

- WCDMA transmitter has to be active before Vinku's RB_EXT voltage can be measured. Procedure is explained in chapter "General instructions for TX troubleshooting".
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to R7521.
- RB_EXT voltage should be 1.325 – 1.375 V.

4.1.2.3.3.2 Is capacitor C7579 in WCDMA PA (N7503) bias line working correctly?

Icont_12 – C7579 short-circuited?

- Check that the capacitor is in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that the capacitor is not short-circuited. If short-circuit is found replace the capacitor.

4.1.2.3.3.3 Replace Vinku (N7501) or WCDMA PA (N7503)

4.1.2.3.4 Replace PA (N7503)

4.1.2.4 Does duplex-filter (Z7502) get correct RF-power from WCDMA PA (N7503)?

- WCDMA transmitter has to be active before measurements. Procedure is explained in chapter "General instructions for TX troubleshooting".
- Set TX power level to 0 dBm (Set start level "0" to Phoenix)
- Measurements can be done with a spectrum analyser and an RF probe. Remember to make correct frequency setting to the spectrum analyser. Spectrum analyser centre frequency should be set according the used TX channel (see chapter "Frequency mappings")
- Spectrum analyser RBW = VBW = 10 MHz, Span $\leq$ 2 MHz, sweep time 100 ms



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- Connect the probe to Z7502 TX input. The RF level should be roughly -20...-30 dBm.

4.1.2.5 Replace duplex-filter Z502

4.1.3 WCDMA transmitter frequency correct?

- Connect a spectrum analyser to the module test jig RF connector.
- Set WCDMA Tx ON. Procedure is explained in chapter "General instructions for TX troubleshooting".
- Check if the frequency of the transmitter is as expected. If output signal is not found try to use 500 MHz span setting.

  The correct TX frequency is shown in Phoenix "Tx Control (WCDMA)" window and can be found also in see chapter "Frequency mappings". If the frequency is not found at all then go to 4.1.1"Does the WCDMA TX transmit RF-power at all?"

4.1.3.1 Is TX VCO frequency as expected?

- WCDMA transmitter has to be active before TX VCO's output frequency and output level can be measured. Procedure is explained in chapter "General instructions for TX troubleshooting".
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used TX channel (see chapter "Frequency mappings"). RBW and VBW = 1 MHz, Span ≤ 200 kHz.
- Connect the RF probe to the T7503 input. VCO shield has to be removed before measurement. Remember to solder the shield back after the phone repairing. *Quick VCO alive check can be done without removing the RF shield. The RF probe should be placed as near the TX VCO output as possible (Put the head of the probe carefully inside the VCO can through the holes of the shield). This method can be used only to check that the TX VCO is alive. It won't expose if the T7503 is broken or the output level of the VCO is too low. Remember to use low RF Attenuator value in the spectrum analyser with this method.*
- Check if the frequency of the TX VCO is as expected. If the VCO signal is not found try to use wider span setting. The output level of the VCO should be about -25 dBm.

4.1.3.1.1 C7543, C7548 and L7517 ok?

- These components should be checked if TX VCO frequency is not stable and TX PLL frequency not locked.
- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that inductor is conducting DC.



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4.1.3.1.2 TX VCO control voltage VC ok?

- WCDMA transmitter has to be active before TX VCO control voltage VC can be measured. Procedure is explained in chapter “General instructions for TX troubleshooting”.
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to R7519.
- TX VCO control voltage VC should be constant DC-voltage between 0.7 - 3.8 V. DC voltage level should change if TX channel is changed. VC is lower on lower channels and higher if higher channel numbers are used.

4.1.3.1.2.1 VCP2-voltage ok?

- GSM transmitter has to be active before VCP2 voltage can be measured. Procedure is explained in chapter “General instructions for TX troubleshooting”.
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C2221 (or C7550).
- VCP2 voltage should be about 4.75 V.

4.1.3.1.2.2 Vinku (N7501) RB_EXT voltage ok?

- WCDMA transmitter has to be active before Vinku’s RB_EXT voltage can be measured. Procedure is explained in chapter “General instructions for TX troubleshooting”.
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to R7521.
- RB_EXT voltage should be 1.325 – 1.375 V.

4.1.3.1.2.3 Balun T7503 ok?

- WCDMA transmitter has to be active before TX VCO’s output level can be measured. Procedure is explained in chapter “General instructions for TX troubleshooting”.
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used TX channel (see chapter “Frequency mappings”). RBW and VBW = 1 MHz, Span ≤ 200 kHz.
- Check the level of the TX VCO frequency in T7503 outputs. The level should be about -30...-35 dBm in both output lines. If the signal level is correct in the input (about -25 dBm) but output level is not as expected then replace T7503. VCO shield has to be removed before measurement. Remember to solder the shield back after the phone repairing.



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4.1.3.1.2.4 Are components near the TX VCO ok?

C7571, R7519, R7523, C7573 and C7568 working correctly?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and check resistors resistance values with an ohmmeter.
- Use an ohmmeter to check also that capacitors are not short-circuited

4.1.3.1.2.5 Replace Vinku (N7501) or TX VCO (G7502) or both

4.1.3.1.3 Replace TX VCO G7502

4.1.3.2 Is TX VCO signal level in the T7503 output high enough?

- WCDMA transmitter has to be active before TX VCO's output level can be measured. Procedure is explained in chapter "General instructions for TX troubleshooting".
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used TX channel (see chapter "Frequency mappings"). RBW and VBW = 1 MHz, Span ≤ 200 kHz.
- Check the level of the VCO frequency in T7503 outputs. The level should be about -30...-35 dBm in both output lines. If the signal level is correct in the input (about -25 dBm) but output level is not as expected then replace T7503. VCO shield has to be removed before measurement. Remember to solder the shield back after the phone repairing.

4.1.3.2.1 TX VCO G7502 output level high enough?

- WCDMA transmitter has to be active before TX VCO's output frequency and output level can be measured. Procedure is explained in chapter "General instructions for TX troubleshooting".
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used TX channel (see chapter "Frequency mappings"). RBW and VBW = 1 MHz, Span ≤ 200 kHz.
- Connect the RF probe to the T7503 input. VCO shield has to be removed before measurement. Remember to solder the shield back after the phone repairing.
- Check if the frequency of the TX VCO is as expected. If the VCO signal is not found try to use wider span setting. The output level of the VCO should be about -25 dBm.



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4.1.3.2.1.1 Replace TX VCO G7502

4.1.3.2.2 Replace balun T7503

4.1.3.3 VCTCXO frequency and output level ok?

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7529 (or C7582)
- The frequency of the VCTCXO should be quite exactly 38.4 MHz and level about 0.5 - 0.9 Vpp. Example of the correct VCTCXO output signal is presented in figure 6.5.1 "VCTCXO Output (DC Offset 1.24V)".

4.1.3.3.1 VXO-voltage ok? (=Vdig).

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7529 (or C7582)
- The frequency of the VCTCXO should be quite exactly 38.4 MHz and level about 0.5 - 0.9 Vpp. Example of the correct VCTCXO output signal is presented in figure 6.5.1 "VCTCXO Output (DC Offset 1.24V)".

4.1.3.3.2 BB AFC-voltage ok?

- Measurement can be done with an oscilloscope and a probe
- Connect the probe to R7509 (or C7533)
- AFC-voltage may vary between 0.1 - 2.3 V. Typical value is 1.2 V. Phoenix “RF Controls” tool can be used to change the AFC value. Voltage level should be about 0.1 V with AFC value -1024 and about 2.3 V with AFC value 1023.

4.1.3.3.3 Replace VCTCXO G7501

## 4.2 Does the phone give realistic RSSI-values?

Attach the phone to the product specific test jig (AD-23) and a signal generator to the RF-coupler. Remember that there are two antenna connectors in the coupler, one for GSM and one for WCDMA. Coupler attenuation should be also taken into account during measurements.

Use the signal generator to supply -90 dBm RF-level to the phone via the antenna coupler. Set generator RF-level to -90 dBm + Cable and coupler attenuation. This measurement should be performed in a RF-shielded environment because existing WCDMA-network base stations can disturb this measurement otherwise.

- Set RF-generator frequency to 2141.0 MHz (unmodulated signal).



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- Use Phoenix testing & tuning software to perform WCDMA receiver activation and RSSI measurement for channel 10700. Procedure is explained in chapters “WCDMA RX chain activation for manual measurement” and “WCDMA RSSI measurement”.
- “Rx Power Measurement” tool should show quite exact -90 dBm RSSI level. Remember to take into account attenuation between the phone and signal generator.
- Increase signal generator RF level to -60 dBm. Phoenix ”Rx Power Measurement” tool should show now quite exact RSSI level -60 dBm.
- If RSSI-levels are not as expected separate the phone into parts and place to the MJ-26 module jig. Connect the signal generator to the module jig WCDMA RF connector (*Notice that there are three antenna connectors in the module jig, one for GSM, one for WCDMA and one for Bluetooth. Make sure that all connections are made to the correct RF-connector*).

4.2.1 Is Hinku ASIC (N7500) receiving RF-power correctly from the WCDMA-antenna connector?

- WCDMA receiver has to be active before measurements. Procedure is explained in chapter “WCDMA RX chain activation for manual measurements”.
- Connect an RF-generator to the WCDMA-antenna connector
- Set RF-generator frequency to 2141.0 MHz (unmodulated signal)
- Measurements can be done with a spectrum analyser and an RF probe. Remember to make correct frequency settings to the spectrum analyser (Centre frequency should be set to the same frequency as the RF-generator). RBW = VBW = 10 kHz, Span = 0, sweep time = 100 ms.
- Connect the probe to T7500 output. There are two output pins because of balanced output. The RF level should be roughly -85...-90 dBm in both output pads when input signal level in WCDMA antenna connector is -50 dBm.

4.2.1.1 Does duplex-filter (Z7502) work properly?

- WCDMA receiver has to be active before measurements. Procedure is explained in chapter “WCDMA RX chain activation for manual measurements”.
- Connect an RF-generator to the WCDMA-antenna connector
- Set RF-generator frequency to 2141.0 MHz (unmodulated signal)
- Measurements can be done with a spectrum analyser and an RF probe. Remember to make correct frequency settings to the spectrum analyser (Centre frequency should be set to the same frequency as the RF-generator). RBW = VBW = 10 kHz, Span = 0, sweep time = 100 ms.
- Connect the probe to the T7500 input. The RF level should be roughly -80...-85 dBm in the input pad when input signal level in WCDMA antenna connector is -50 dBm.



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4.2.1.1.1 Replace filter Z7502

4.2.1.2 Replace balun T7500

4.2.2 Hinku WCDMA LNA output ok?

- WCDMA receiver has to be active before measurements. Procedure is explained in chapter "WCDMA RX chain activation for manual measurements".
- Connect an RF-generator to the WCDMA-antenna connector
- Set RF-generator frequency to 2141.0 MHz (unmodulated signal)
- Measurements can be done with a spectrum analyser and an RF probe. Remember to make correct frequency settings to the spectrum analyser (Centre frequency should be set to the same frequency as the RF-generator). RBW = VBW = 10 kHz, Span = 0, sweep time = 100 ms.
- Connect the probe to the Z7501 input. The RF level should be roughly -65...-70 dBm in both input pads when input signal level in WCDMA antenna connector is -50 dBm.

4.2.2.1 Replace Hinku N7500

4.2.3 WCDMA SAW Z7501 in place and working correctly?

- WCDMA receiver has to be active before measurements. Procedure is explained in chapter "WCDMA RX chain activation for manual measurements".
- Connect an RF-generator to the WCDMA-antenna connector
- Set RF-generator frequency to 2141.0 MHz (unmodulated signal)
- Measurements can be done with a spectrum analyser and an RF probe. Remember to make correct frequency settings to the spectrum analyser (Centre frequency should be set to the same frequency as the RF-generator). RBW = VBW = 10 kHz, Span = 0, sweep time = 100 ms.
- Connect the probe to the Z7501 output. The RF level should be roughly -70...-75 dBm in both output pads when input signal level in WCDMA antenna connector is -50 dBm.

4.2.3.1 Replace SAW Z7501

4.2.4 Are RX-IQ signal waveforms and levels correct?

- Measurements can be done with an oscilloscope, a probe and signal generator.
- WCDMA receiver has to be active before RX IQ-signals can be measured. Procedure is explained in chapter "WCDMA RX chain activation for manual measurements".
- Apply –50 dBm RF-signal (unmodulated) from a signal generator to the module jig antenna connector and use frequency 2140.1 MHz (Channel 10700)
- Remember to change the correct RX channel also to Phoenix "RX control" window!



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- Check RX I and RX Q -signals in following test points:

- RX I (positive): Connect the probe to test point J7508
- RX I (negative): Connect the probe to test point J7509
- RX Q (positive): Connect the probe to test point J7510
- RX Q (negative): Connect the probe to test point J7511

- Signal in all four test points should be about the same. Output should be a sine wave with frequency 100 kHz and amplitude about 650 mV.
- Change the signal generator to frequency 2142.0 MHz (Channel 10700)
- Signal in all four test points should be about the same. Output should be a sine wave with frequency 2.0 MHz and amplitude about 550 mV.

#### 4.2.4.1 RF operating voltage VBAT_ASIC ok?

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7503 (or C7501, C7541)
- VBAT_ASIC voltage level should be 3.05 – 5.4 V. Typical value is 4.0 V.

#### 4.2.4.2 RFBUS signals ok?

- GSM receiver has to be active before RFBUS signals can be measured. Procedure is explained in chapter “GSM RX chain activation for manual measurements”. Also WCDMA/GSM transmitter and WCDMA receiver activation can be used for the measurement but then RFBUS -signals don’t necessarily look like in figures mentioned below.
- Measurements can be performed with an oscilloscope and a probe. Check all five RF BUS signals:

- *RFBUSDAT*: Connect the probe to J7504. Typical RFBUSDAT -signal is shown in section 6.5.9.3 "RFBUSDAT (GSM RX)".

- *RFBUSCLK*: Connect the probe to J7505. Typical RFBUSCLK -signal is shown in figures “RFBUSCLK (GSM RX)” and “RBUSCLK and RFBUSENA (GSM RX)”.

- *RFBUSENA*: Connect the probe to J7506. Typical RFBUSENA -signal is shown in the figure “RFBUSCLK and RFBUSENA (GSM RX)”.

- *RXRESETX*: Connect the probe to J7515. RXRESETX -signal is a constant 2 V DC-signal after GSM or WCDMA transceiver has been activated the first time after phone boot up. The level of this signal should be about 0 V before transceiver activation.

- *TXRESETX*: Connect the probe to J7517. TXRESETX -signal is a constant 2 V DC-signal after GSM or WCDMA transceiver has been activated the first time after phone boot up. The level of this signal should be about 0 V before transceiver activation.



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4.2.4.3 Hinku (N7500) regulator voltage VR1 ok?

- WCDMA receiver has to be active before Hinku's VR1 voltage can be measured. Procedure is explained in chapter "WCDMA RX chain activation for manual measurements".
- Measurements can be done with an oscilloscope and a probe.
- Connect the probe to C7504 (or C7505)
- VR1 voltage level should be 2.65 – 2.86 V. Typical value is 2.7 V.

4.2.4.3.1 Hinku (N7500) RB_EXT voltage ok?

- WCDMA receiver has to be active before Hinku's RB_EXT voltage can be measured. Procedure is explained in chapter "WCDMA RX chain activation for manual measurements".
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to R7504.
- RB_EXT voltage should be 1.325 – 1.375 V.

4.2.4.3.1.1 VREFRF01-voltage ok?

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to R7503.
- VREFRF01 voltage should be 1.325 – 1.375 V. Typical value is 1.35 V.

4.2.4.3.1.1.1 Desolder R7503. Is VREFRF01 voltage still wrong?

Remember to solder a new component to R7503 pads after measurement.

4.2.4.3.1.1.1.1 Capacitors C7518, C7520 and C7570 working correctly?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that capacitors are not short-circuited. If short-circuit is found replace capacitors mentioned above. If this does not help go to the next step.

4.2.4.3.1.1.1.2 Replace Vinku (N7501) or Hinku (N7500) or both

4.2.4.3.1.1.2 Retu ok?

4.2.4.3.1.2 R7521 and R7504 in place and working correctly?

- Check that components are in place and solder joints are ok



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- Disconnect the power supply from the phone and check R7521 and R7504 resistance values with an ohmmeter.

4.2.4.3.1.3 VB_EXT voltage ok?

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7518.
- VB_EXT voltage should be 1.325 – 1.375 V. Typical value is 1.35 V.

4.2.4.3.1.3.1 R7503 in place and working correctly?

- Check that the component is in place and solder joints are ok
- Disconnect the power supply from the phone and check R7503 resistance value with an ohmmeter

4.2.4.3.1.3.2 Capacitors C7518, C7520 and C7570 working correctly?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that capacitors are not short-circuited. If short-circuit is found replace capacitors mentioned above. If this does not help go to the next step.

4.2.4.3.1.3.3 Replace Hinku (N7500) or Vinku (N7501) or both

4.2.4.3.1.4 Replace Hinku (N7500)

4.2.4.3.2 Are capacitors in Hinku (N7500) regulator lines working correctly?

C7504, C7515, C7509, C7508, C7596, C7598 and C7505

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that capacitors are not short-circuited. If short-circuit is found replace capacitors mentioned above. If this does not help go to the next step.

4.2.4.3.3 RX VCO G7500 ok?

4.2.4.3.4 Replace Hinku (N7500)

4.2.4.4 VXO-voltage ok? (=Vdig).

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7529 (or C7582)



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- The frequency of the VCTCXO should be quite exactly 38.4 MHz and level about 0.5 - 0.9 Vpp. Example of the correct VCTCXO output signal is presented in figure 6.5.1 "VCTXO Output (DC Offset 1.24V)".

4.2.4.5 VCP1-voltage ok?

- WCDMA receiver has to be active before VCP1 voltage can be measured. Procedure is explained in chapter "WCDMA RX chain activation for manual measurements".
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7507.
- VCP1 voltage should be about 4.75 V.

4.2.4.5.1 C7507 and C2222 ok?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that capacitors C7507 and C2222 are not short-circuited. If short-circuit is found replace faulty capacitor. If this does not help go to the next steps.

4.2.4.5.2 Retu ok?

4.2.4.5.3 Hinku (N7500) ok?

4.2.4.6 Is there RF power in the RX VCO output at all?

- WCDMA receiver has to be active before RX VCO's output frequency and output level can be measured. Procedure is explained in chapter "WCDMA RX chain activation for manual measurements".
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used RX channel (see chapter "Frequency mappings". RBW and VBW = 1 MHz, Span ≤ 200 kHz.
- Connect the RF probe to the T7501 input.
- Check if the frequency of the RX VCO is as expected. If the VCO signal is not found try to use wider span setting. The output level of the VCO should be about -20...-30 dBm.

4.2.4.6.1 RX VCO operating voltage VR1 ok?

- GSM receiver has to be active before Hinku's VR1 voltage can be measured. Procedure is explained in chapter "GSM RX chain activation for manual measurements".
- Measurements can be done with an oscilloscope and a probe.



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- Connect the probe to C7504 (or C7505) VR1 voltage level should be 2.65 – 2.86 V. Typical value is 2.7 V.

4.2.4.6.2 Replace RX VCO (G7500)

4.2.4.7 Is RX VCO RF-signal coming to the Hinku at all?

- WCDMA receiver has to be active before RX VCO's output frequency and output level can be measured. Procedure is explained in chapter "WCDMA RX chain activation for manual measurements".
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used RX channel (see chapter "Frequency mappings"). RBW and VBW = 1 MHz, Span ≤ 200 kHz.
- Check the level of the VCO frequency in T7501 outputs. The level should be about -25...-35 dBm. If the signal level is correct in the input (-20...-30 dBm) but output level is not as expected then replace T7501.

4.2.4.7.1 Replace balun T7501

4.2.4.8 Is RX VCO frequency as expected?

- WCDMA receiver has to be active before RX VCO's output frequency and output level can be measured. Procedure is explained in chapter "WCDMA RX chain activation for manual measurements".
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used RX channel (see chapter "Frequency mappings"). RBW and VBW = 1 MHz, Span ≤ 200 kHz.
- Connect the RF probe to the T7501 input.
- Check if the frequency of the RX VCO is as expected. If the VCO signal is not found try to use wider span setting. The output level of the VCO should be about -20...-30 dBm.

4.2.4.8.1 RX VCO control voltage VC ok?

- WCDMA receiver has to be active before RX VCO control voltage VC can be measured. Procedure is explained in chapter "WCDMA RX chain activation for manual measurements".
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to R7501.
- RX VCO control voltage VC should be constant DC-voltage between 0.7 - 3.8 V. Voltage level should change if RX channel is changed. VC is lower on lower channels and higher if higher channel numbers are used.



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4.2.4.8.1.1 VCP1-voltage ok?

- GSM receiver has to be active before VCP1 voltage can be measured. Procedure is explained in chapter "WCDMA RX chain activation for manual measurements".
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7507.
- VCP1 voltage should be about 4.75 V.

4.2.4.8.1.1.1 C7507 and C2222 working properly?

- Check that the components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that C507 and C2222 are not short-circuited.

4.2.4.8.1.1.2 Retu ok?

Hinku (N7500) ok?

4.2.4.8.1.1.2.1 Hinku (N7500) RB_EXT voltage ok?

- GSM receiver has to be active before Hinku's RB_EXT voltage can be measured. Procedure is explained in chapter "GSM RX chain activation for manual measurements"
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to R7504.
- RB_EXT voltage should be 1.325 – 1.375 V.

4.2.4.8.1.2 Balun T7501 ok?

- WCDMA receiver has to be active before RX VCO's output frequency and output level can be measured. Procedure is explained in chapter "WCDMA RX chain activation for manual measurements".
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used RX channel (see chapter "Frequency mappings"). RBW and VBW = 1 MHz, Span ≤ 200 kHz.
- Check the level of the VCO frequency in T7501 outputs. The level should be about -25...-35 dBm. If the signal level is correct in the input (about -20...-30 dBm) but output level is not as expected then replace T7501.

4.2.4.8.1.3 Are components near the RX VCO ok?

R7501, C7516, R7505, C7524 and C7522 working correctly?



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- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and check resistors resistance values with an ohmmeter.
- Use an ohmmeter to check also that capacitors are not short-circuited

4.2.4.8.1.4 Replace Hinku (N7500) or RX VCO (G7500) or both

4.2.4.8.2 Replace RX VCO G7500

4.2.4.9 Is RX VCO signal level in the T7501 output high enough?

- WCDMA receiver has to be active before RX VCO's output frequency and output level can be measured. Procedure is explained in chapter "WCDMA RX chain activation for manual measurements".
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used RX channel (see chapter "Frequency mappings"). RBW and VBW = 1 MHz, Span ≤ 200 kHz.
- Check the level of the VCO frequency in T7501 outputs. The level should be about -25...-35 dBm. If the signal level is correct in the input (about -20...-30 dBm) but output level is not as expected then replace T7501.

4.2.4.9.1 RX VCO G7500 output level high enough?

- WCDMA receiver has to be active before RX VCO's output frequency and output level can be measured. Procedure is explained in chapter "WCDMA RX chain activation for manual measurements".
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used RX channel (see chapter "Frequency mappings"). RBW and VBW = 1 MHz, Span ≤ 200 kHz.
- Connect the RF probe to the T7501 input.
- Check if the frequency of the RX VCO is as expected. If the VCO signal is not found try to use wider span setting. The output level of the VCO should be about -20...-30 dBm.

4.2.4.9.1.1 Replace RX VCO G7500

4.2.4.9.2 Replace balun T7501

4.2.4.10 Are capacitors C7530, C7532, C7534 and C7536 in place?

- Check that components are in place and solder joints are ok



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4.2.4.11 VCTCXO frequency and output level correct?

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7529 (or C7582)
- The frequency of the VCTCXO should be quite exactly 38.4 MHz and level about 0.5 - 0.9 Vpp. Example of the correct VCTCXO output signal is presented in figure 6.5.1 "VCTCXO Output (DC Offset 1.24V)".

4.2.4.11.1 VXO-voltage ok? (=Vdig).

- Measurement can be done with an oscilloscope and a probe
- Connect the probe to C7560 (or C7526, C7513)
- VXO-voltage should be about 2.5 V

4.2.4.11.2 BB AFC-voltage ok?

- Measurement can be done with an oscilloscope and a probe
- Connect the probe to R7509 (or C7533)
- AFC-voltage may vary between 0.1 - 2.3 V. Typical value is 1.2 V. Phoenix “RF Controls” tool can be used to change the AFC value. Voltage level should be about 0.1 V with AFC value -1024 and about 2.3 V with AFC value 1023.

4.2.4.11.3 Replace VCTCXO G7501

4.2.5 Does RAP3G ASIC get ok VREFCM-signal from Hinku (N7500)? Signal level ok?

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to J7516.
- VREFCM voltage should be about 780 mV (continuous voltage).

4.2.5.1 Hinku (N7500) RB_EXT voltage ok?

- WCDMA receiver has to be active before Hinku’s RB_EXT voltage can be measured. Procedure is explained in chapter “WCDMA RX chain activation for manual measurements”.
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to R7504.
- RB_EXT voltage should be 1.325 – 1.375 V.



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4.2.5.2 Replace Hinku (N7500)

- Also RAP3G can be faulty but it's not possible to replace this component

4.2.6 RAP3G faulty?

- Not possible to replace!

## 4.3 WCDMA modulation spectrum and ACLR ok?

- WCDMA transmitter has to be active before measurements. Procedure is explained in chapter "General instructions for TX troubleshooting".
- Measurement can be done with a WCDMA transmitter tester or other WCDMA communication tester. Settings have to be done according to the 3GPP specifications. Modulation spectrum and ACLR measurements are possible to perform also with a spectrum analyser, but in this case measurement settings have to be done manually according to the 3GPP specifications.
- Attach the phone to the product specific test jig (AD-23) and a spectrum analyser or other RF-measurement device to the RF-coupler. Remember that there are two antenna connectors in the coupler, one for GSM and one for WCDMA. Coupler attenuation should be also taken into account during measurements.
- If modulation spectrum is not as expected separate the phone into parts and place to the MJ-26 module jig (*Notice that there are three antenna connectors in the module jig, one for GSM, one for WCDMA and one for Bluetooth. Make sure that all connections are made to the correct RF-connector*).

4.3.1 Does N7504 give correct voltage level (Vcc11) to the WCDMA PA (N7503)?

- WCDMA transmitter has to be active before measurements. Procedure is explained in chapter "General instructions for TX troubleshooting".
- Set TX power level to -40 dBm (Set start level to "-40.0" in Phoenix)
- Measurements can be done with an oscilloscope and a probe.
- Connect the probe to C7580.
- Vcc11 voltage level should be about 1.5 V. The same voltage level should be measured also with all power levels smaller than about 10 dBm. Vcc11 is about 3.3 V with the highest power (21 dBm). NOTE: Perform WCDMA transmitter tests with > 0 dBm power only in RF shielded environment.

4.3.2 Does WCDMA PA (N7503) get correct bias currents Icont11 and Icont12?

- WCDMA transmitter has to be active before measurements. Procedure is explained in chapter "General instructions for TX troubleshooting".



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- Set TX power level to -40 dBm (Set start level to "-40.0" in phoenix)
- Measurements can be done with an oscilloscope and a probe.

- Connect the probe to C7579
- WCDMA PA bias current Icont_12 should look as a constant 2.5 - 2.6 V DC-voltage with all power levels.
- Connect the probe to C7576 pad. Notice: C7576 is a non-assembled component so the probe should be connected to the pad that can be still found from the PWB.

- WCDMA PA bias current Icont_11 should look as a constant 2.5 - 2.6 V DC-voltage with all power levels.

#### 4.3.3 Are TX-IQ signals ok?

- These current mode signals are not possible to measure, but are tested with self tests. So if there is no fail in 2.4 "ST_CDSP_TX_IQ_TEST" these signals should be ok. Otherwise Vinku (N7501) or RAP3G (D2800) is faulty. Notice that it is not possible to replace RAP3G ASIC.

##### 4.3.3.1 TX VCO G7502 output level high enough?

- WCDMA transmitter has to be active before TX VCO's output frequency and output level can be measured. Procedure is explained in chapter "General instructions for TX troubleshooting".
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used TX channel (see chapter "Frequency mappings"). RBW and VBW = 1 MHz, Span ≤ 200 kHz.
- Connect the RF probe to the T7503 input. VCO shield has to be removed before measurement. Remember to solder the shield back after the phone repairing.
- Check if the frequency of the TX VCO is as expected. If the VCO signal is not found try to use wider span setting. The output level of the VCO should be about -25 dBm.

###### 4.3.3.1.1 Replace TX VCO G7502

##### 4.3.3.2 Replace balun T7503

#### 4.3.4 Is TX VCO signal level in the T7503 output high enough?

- WCDMA transmitter has to be active before TX VCO's output level can be measured. Procedure is explained in chapter "General instructions for TX troubleshooting".
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used TX channel (see chapter "Frequency mappings"). RBW and VBW = 1 MHz, Span ≤ 200 kHz.



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- Check the level of the VCO frequency in T7503 outputs. The level should be about -30...-35 dBm in both output lines. If the signal level is correct in the input (about -25 dBm) but output level is not as expected then replace T7503. VCO shield has to be removed before measurement. Remember to solder the shield back after the phone repairing.

4.3.5 Replace Vinku (N7501) or WCDMA PA (N7503) or both

## 5. DOES THE PHONE HAVE A RELIABLE CONNECTION TO THE NETWORK (GSM)?

This chapter means situation when the phone registers to the GSM-network and is capable to make a call, but the call is not reliable even if GSM-network field strength is strong. The phone call is maybe disconnected or interrupted.

### 5.1 GSM receiver Bit Error Rate (BER) ok?

- This test needs a GSM communication tester and if there is no that kind of tester available continue troubleshooting in chapter 3.2 "Does the phone give realistic RSSI-values?".
- Attach the phone to the product specific test jig (AD-23) and a GSM communication tester to the RF-coupler. Remember that there are two antenna connectors in the coupler, one for GSM and one for WCDMA. Coupler attenuation should be also taken into account during measurements. This measurement should be done in an RF shield box.
- Close the shield box hatch.
- Make a GSM call against the tester
- Settings to the tester have to be done according to the 3GPP specifications:
- Set base station downlink power to -102 dBm
- Bit Error Rate should be less than 2 %

5.1.1 Does the phone give realistic RSSI-values?

- See section 3.2. "Does the phone give realistic RSSI-values?"

5.1.2 Hinku (N7500) or RAP3G (D2800) faulty?

- RAP3G is not possible to replace

### 5.2 GSM transmitter power levels and transmit frequency ok?

- See section 3.1. "GSM transmitter power levels and transmit frequency ok?"

### 5.3 GSM Transmitter phase error ok?

- See section 3.3. "GSM Transmitter phase error ok?"



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### 5.4 GSM (GMSK) modulation spectrum ok?

- See section 3.4. "GSM (GMSK) modulation spectrum ok?"

### 5.5 TX power vs. time ok?

- See section 3.5. "TX power vs. time ok?"

## 6. DOES THE PHONE HAVE A RELIABLE CONNECTION TO THE NETWORK (WCDMA)?

This chapter means situation when the phone registers to the WCDMA-network and is capable to make a call, but the call is not reliable even if WCDMA-network field strength is strong. The phone call is maybe disconnected or interrupted.

### 6.1 WCDMA receiver Bit Error Rate (BER) ok?

- This test needs a WCDMA communication tester and if there is no that kind of tester available continue troubleshooting in chapter 4.2 "Does the phone give realistic RSSI-values?".
- Attach the phone to the product specific test jig (AD-23) and a GSM communication tester to the RF-coupler. Remember that there are two antenna connectors in the coupler, one for GSM and one for WCDMA. Coupler attenuation should be also taken into account during measurements. This measurement should be done in an RF shield box.
- Close the shield box hatch.
- Make a GSM call against the tester
- Settings to the tester have to be done according to the 3GPP specifications:

- Set base station output level (Îor) to -106.7 dBm / 3.84 MHz

- Set DPCH_Ec level to -117 dBm / 3.84 MHz

- Bit Error Rate should be less than 0.1 %

#### 6.1.1 Does the phone give realistic RSSI-values?

- See section 3.2. "Does the phone give realistic RSSI-values?"

#### 6.1.2 Hinku (N7500) or RAP3G (D2800) faulty?

- RAP3G is not possible to replace



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## 6.2 WCDMA TX power and transmit frequency ok?

- See section 4.1. "WCDMA TX power and transmit frequency ok?"

## 6.3 WCDMA Transmitter error vector magnitude ok?

- This test needs a WCDMA communication tester and if there is no that kind of tester available continue troubleshooting in section 4.3 "WCDMA modulation spectrum and ACLR ok?"
- Attach the phone to the product specific test jig (AD-23) and the WCDMA communication tester to the RF-coupler. Remember that there are two antenna connectors in the coupler, one for GSM and one for WCDMA. Coupler attenuation should be also taken into account during measurements. This measurement should be done in an RF shield box.
- Close the shield box hatch.
- Make a WCDMA call against the tester
- The Error Vector Magnitude shall not exceed 17.5 % with power levels ≥ –20 dBm.
- If Error Vector Magnitude is not as expected separate the phone into parts and place to the MJ-26 module jig (*Notice that there are three antenna connectors in the module jig, one for GSM, one for WCDMA and one for Bluetooth. Make sure that all connections are made to the correct RF-connector*).

### 6.3.1 Is capacitor C7579 in WCDMA PA (N7503) bias line in place?

- Check that the component is in place and solder joints are ok

### 6.3.2 Are capacitors in Vinku REG1 and REG2 lines in place?

C7554, C7555 and C7547

- Check that components are in place and solder joints are ok

### 6.3.3 Are capacitors in WCDMA PA power supply lines in place?

C7569 and C7583

- Check that components are in place and solder joints are ok

### 6.3.4 Are TX-IQ signals ok?

- These current mode signals are not possible to measure, but are tested with self tests. So if there is no fail in section 2.4. "ST_CDSP_TX_IQ_TEST" these signals should be ok. Otherwise Vinku (N7501) or RAP3G (D2800) is faulty. Notice that it is not possible to replace RAP3G ASIC.



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6.3.5 Is TX VCO signal level in the T7503 output high enough?

- WCDMA transmitter has to be active before TX VCO's output level can be measured. Procedure is explained in chapter "General instructions for TX troubleshooting".
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used TX channel (see chapter "Frequency mappings"). RBW and VBW = 1 MHz, Span ≤ 200 kHz.
- Check the level of the VCO frequency in T7503 outputs. The level should be about -30...-35 dBm in both output lines. If the signal level is correct in the input (about -25 dBm) but output level is not as expected then replace T7503. VCO shield has to be removed before measurement. Remember to solder the shield back after the phone repairing.

6.3.6 VCTCXO frequency and output level correct?

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7529 (or C7582)
- The frequency of the VCTCXO should be quite exactly 38.4 MHz and level about 0.5 - 0.9 Vpp. Example of the correct VCTCXO output signal is presented in figure 6.5.1 "VCTCXO Output (DC Offset 1.24 V)"..

## 6.4 WCDMA modulation spectrum and ACLR ok?

- See section 4.3 "WCDMA modulation spectrum and ACLR ok?"



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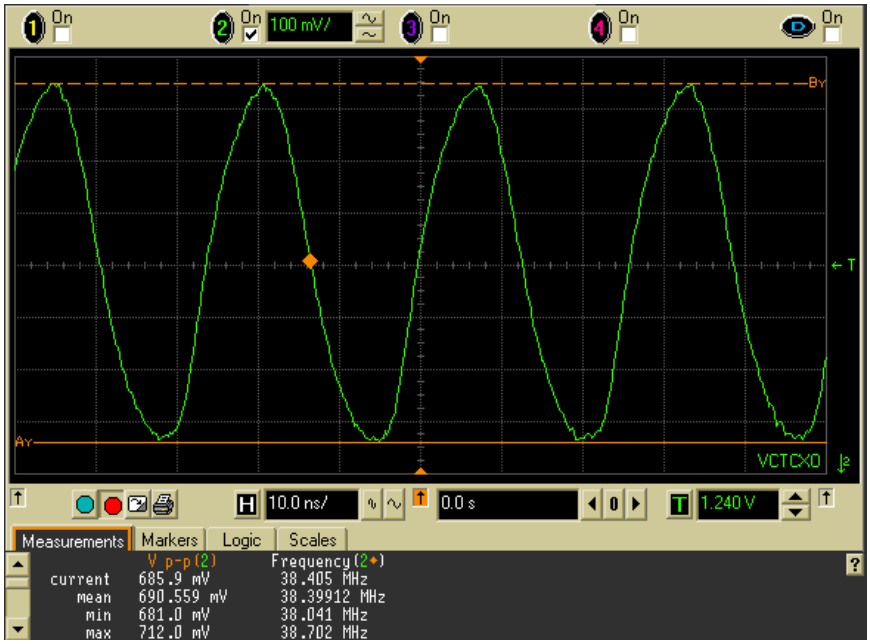
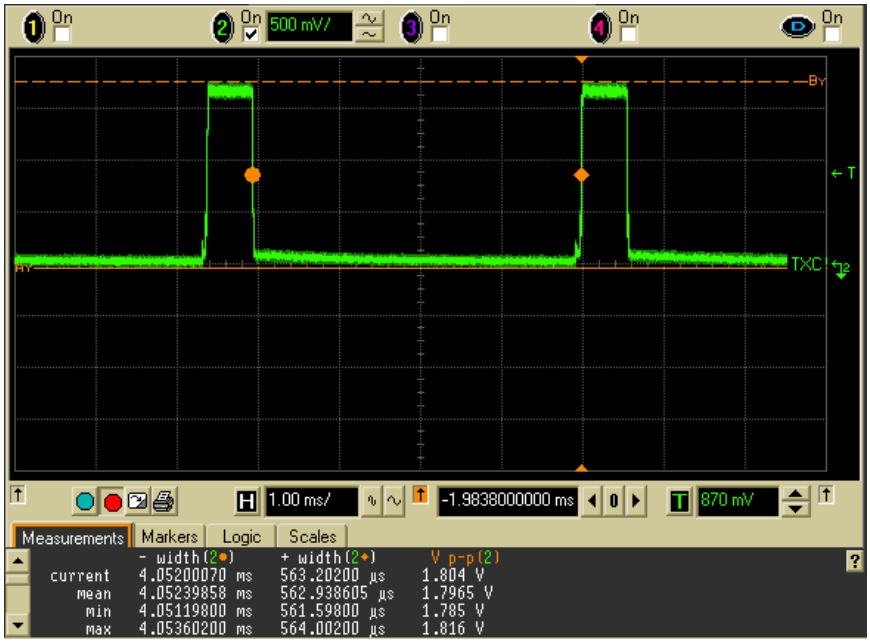
## 6.5 Troubleshooting pictures

### 6.5.1 VCTCXO Output (DC Offset 1.24 V)




### 6.5.2 TXC in GSM mode (DC Offset 0 V)



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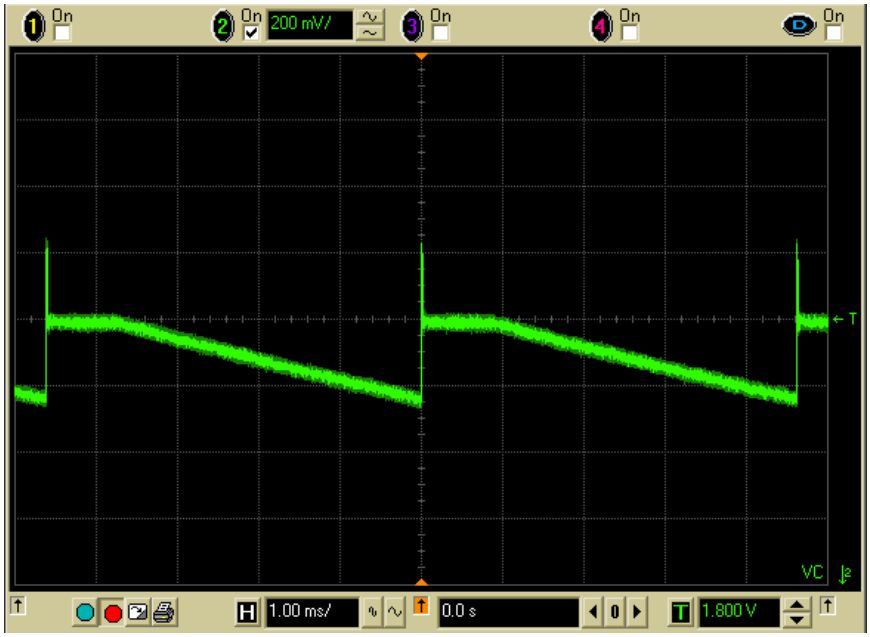
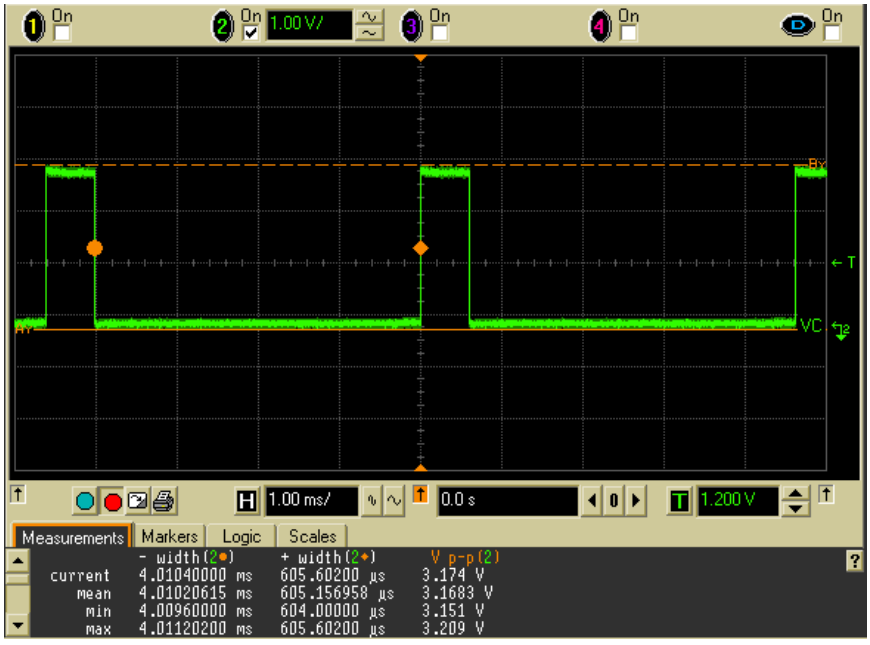
### 6.5.3 TX VC in GSM mode (DC Offset 1.8 V)




DC value changes if channel or band is changed. Upper figure has been taken in EGSM900 band and on channel 37.

### 6.5.4 Icont_21/Icont_22 (DC Offset 1.2 V)



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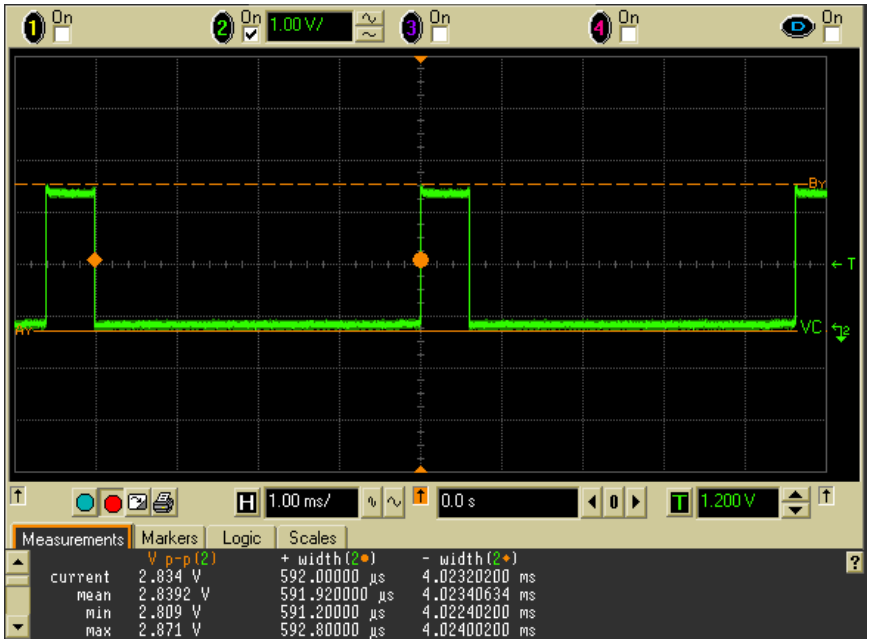
### 6.5.5 Icont_31/Icont_32 (DC Offset 1.2 V)



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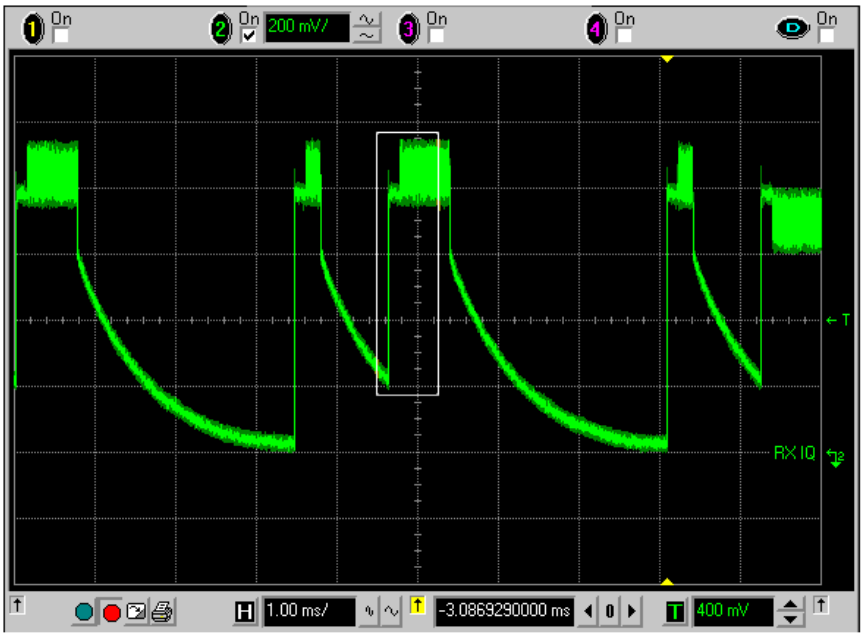
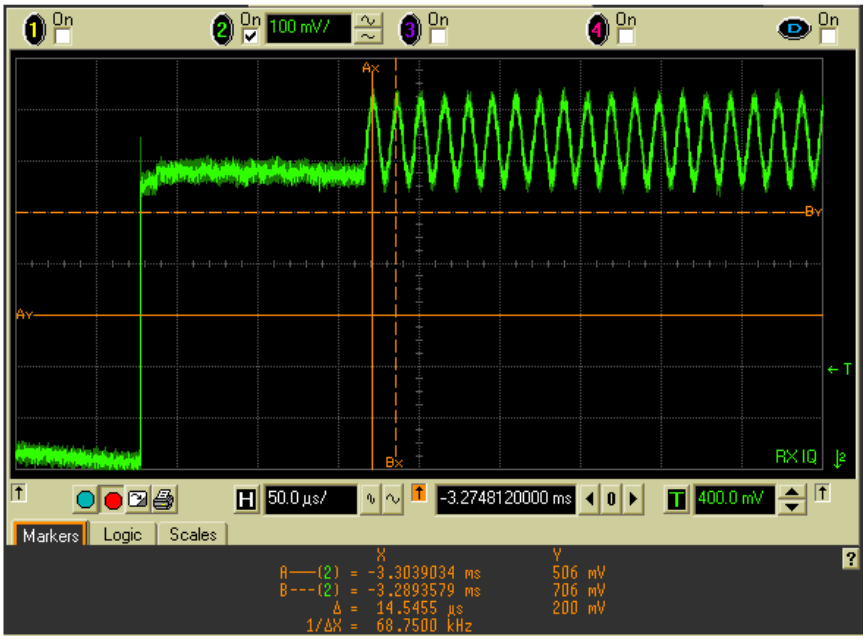
### 6.5.6 GSM RX IQ (DC Offset 0.4 V)




The lower figure is a detail from the upper figure (detail area marked with a white box).



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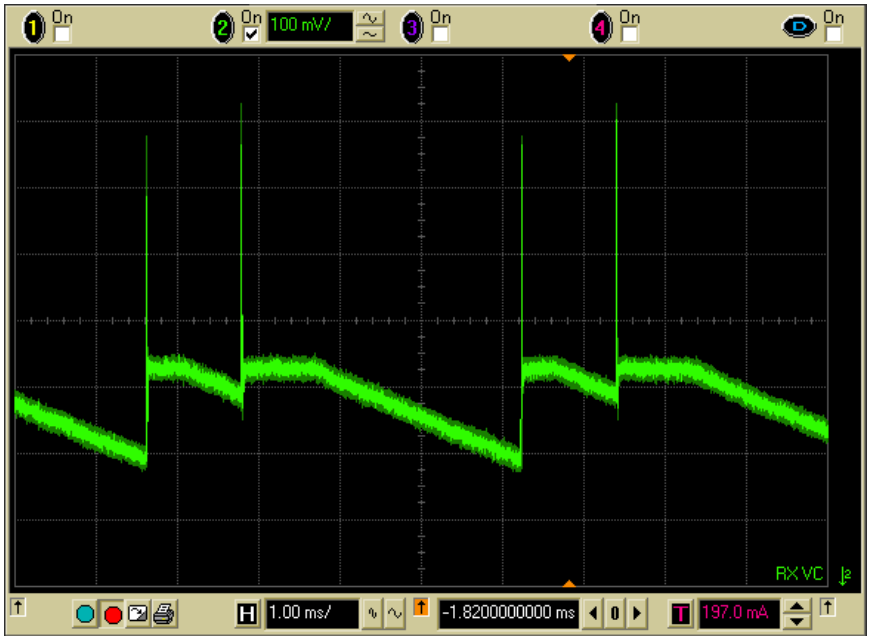
### 6.5.7 RX VC in GSM mode (DC Offset 1.5 V)




DC value changes if channel or band is changed. Upper figure has been taken in EGSM900 band and on channel 37.



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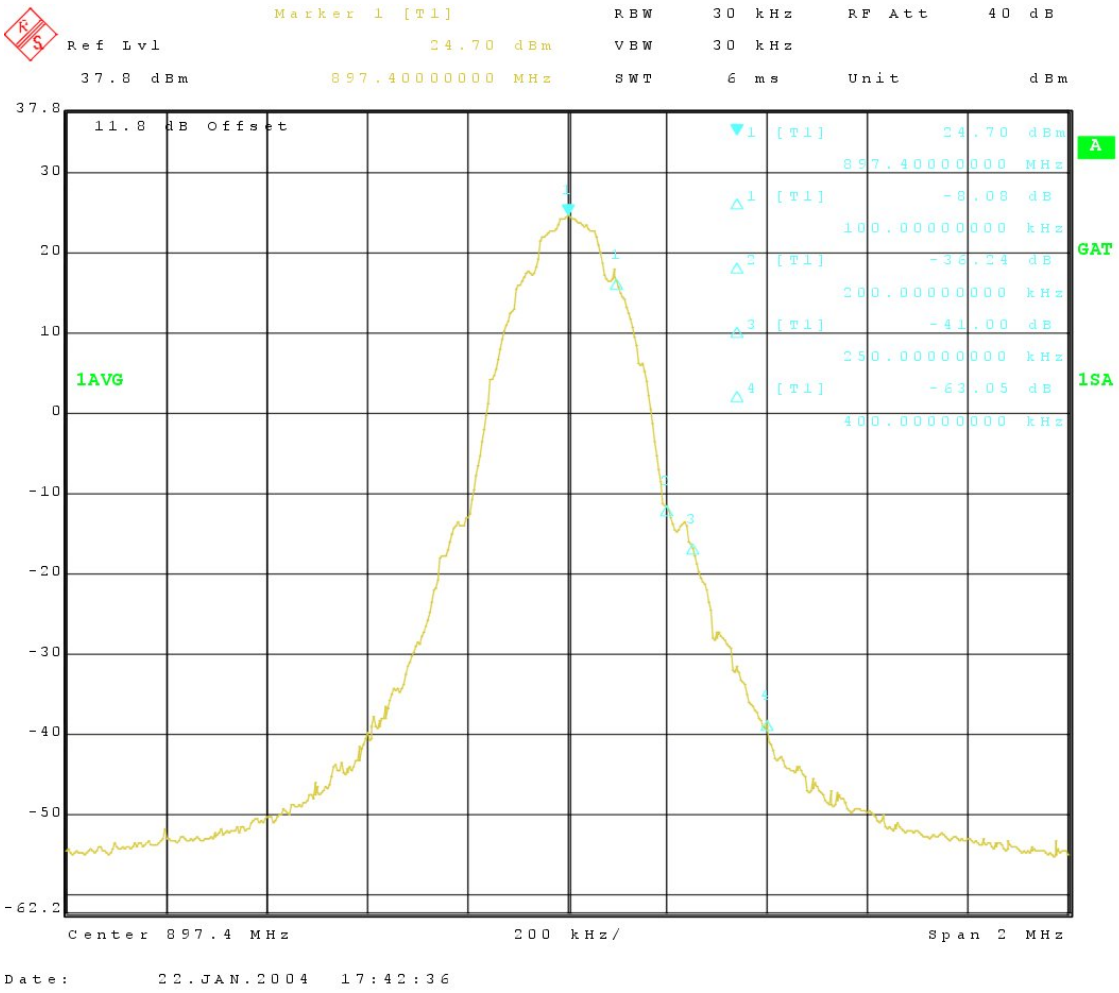
### 6.5.8 TX Modulation spectrum (GSM)




Example of the TX modulation spectrum (GMSK) in EGSM900 band.



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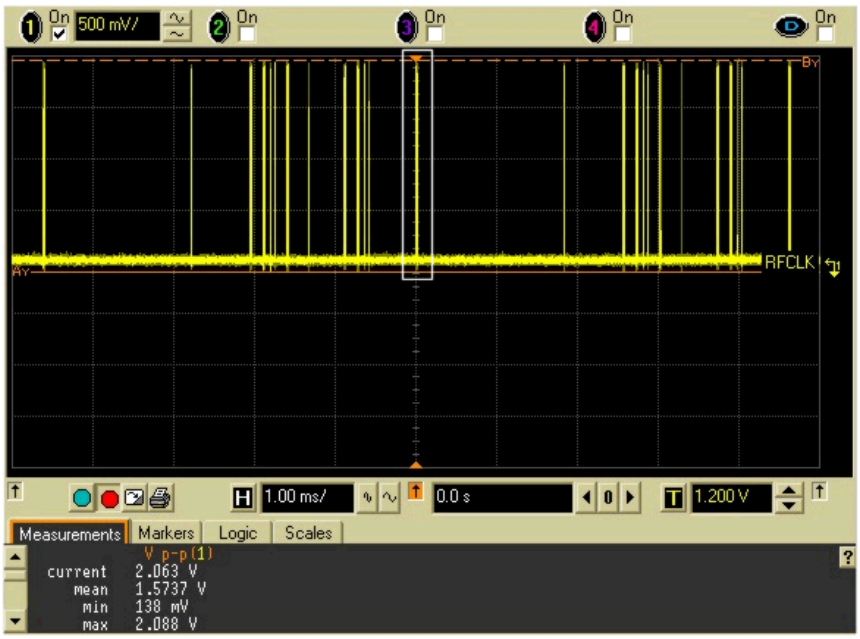
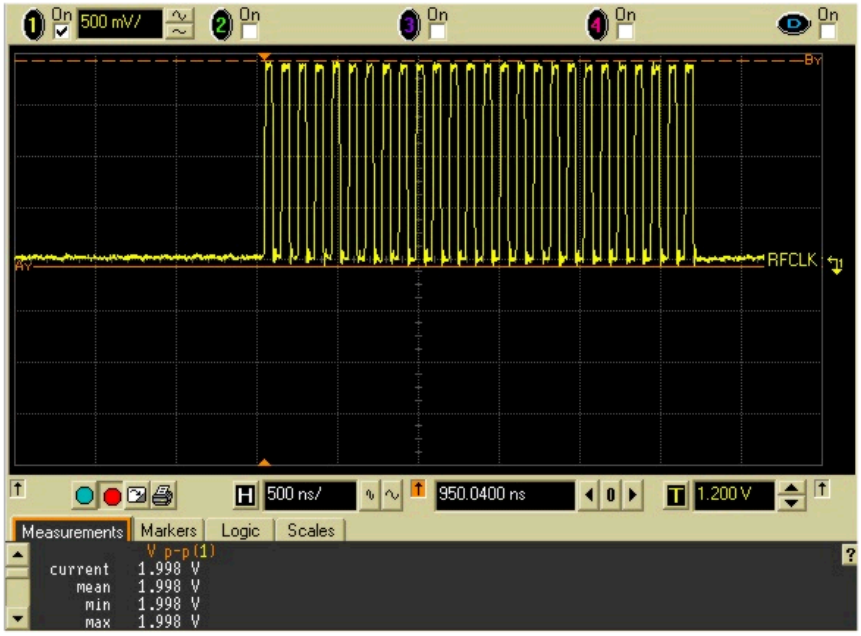
### 6.5.9 RFBUS

#### 6.5.9.1 RFBUSCLK (GSM RX)

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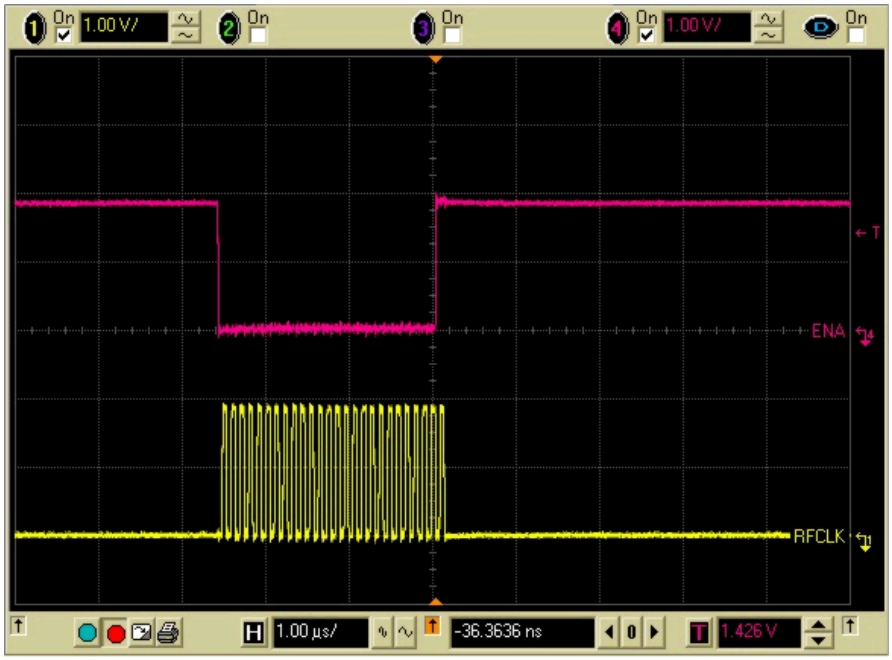
### 6.5.9.2 RFBUSCLK and RFBUSENA (GSM RX)



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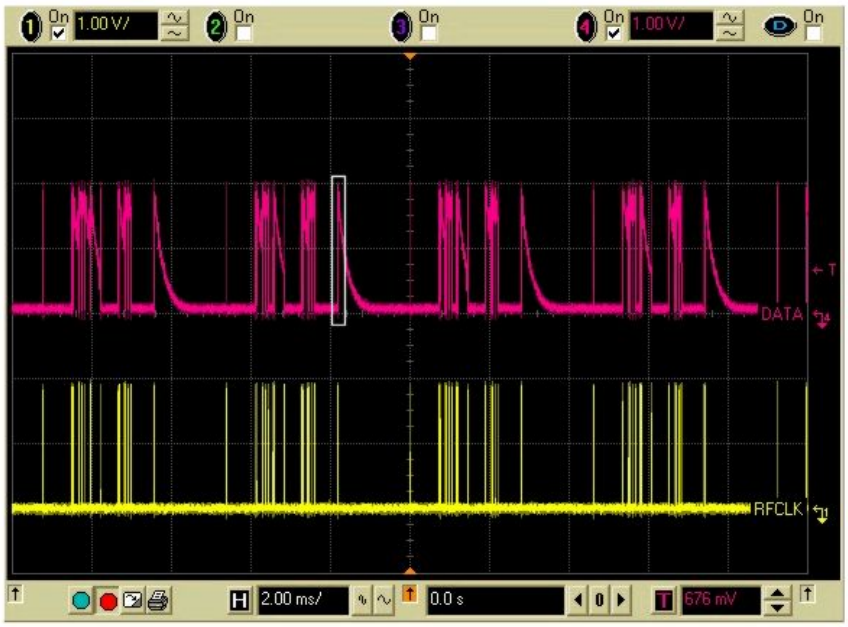
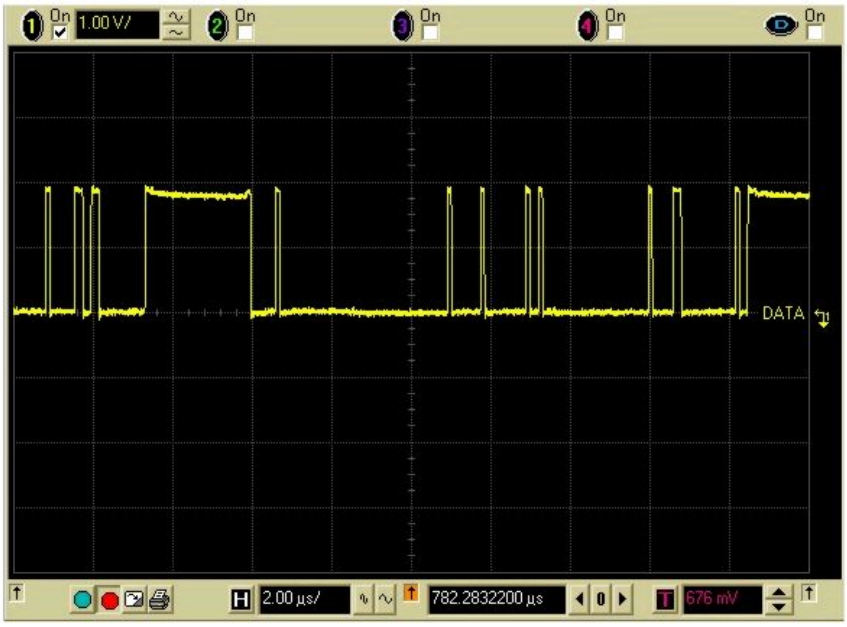
### 6.5.9.3 RFBUSDAT (GSM RX)

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